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THE QUARTERLY BULLETIN

The Quarterly Bulletin of the Michigan Agricultural Experiment Station is issued in February, May, August and November. It presents: (1) progress reports on long-term major research projects; (2) final reports on short-term projects and (3) short, timely articles of a popular nature that bring together information from various sources on subjects in which farmers are interested.

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EFFECT OF THE INCREASED BIRTH RATE ON SCHOOL ENROLLMENTS AND SCHOOL-BUILDING NEEDS

By J. F. THADEN
SECTION OF SOCIOLOGY AND ANTHROPOLOGY

DURING every year since 1941, Michigan has produced a bumper baby crop. In not a single year previous to 1941 had as many as one hundred thousand births been recorded in the state. In not a single year since 1940 have as few as one hundred thousand births occurred.

The Michigan Department of Health reports a total of 160,315 births in the state for the year 1947. This is 21,743 more births than occurred in 1946, and 48,758 more than in 1945. It is approximately twice the number of births registered in 1933. The figure for that year was 80,482.

During the 6 years from 1942 through 1947, 256,433 more babies were born than in the same 6-year period during the 1930's. This increase in the birth rate will obviously necessitate expanded school facilities. If one estimates on the basis of 30 pupils a room, 8,548 new classrooms would be required. If the average cost of a new classroom is estimated at $20,000, this crop of war babies and postwar babies calls for an investment of 171 million dollars in new or additional school-room space.

The Michigan Public Education Study Commission in its Report of 1944 indicated the sad financial plight of Michigan's public school buildings. It estimated that about 99 million dollars was necessary for an adequate 10-year construction program for school buildings. Since that time, building costs have more than doubled and accumulated needs have increased until now the total school building demand would probably be in the neighborhood of 300 million dollars. During the next 20 years, the current need for additional classroom facilities in Michigan will be greatly accentuated by the unusually high birth rate of 1942 and subsequent years.

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The 160,315 babies born in Michigan last year will have entered kindergarten in 1953. Thirteen years later, that is, in 1965, a majority of them will have graduated from high school. Truly, the record of births during the 1940's provides proof of the magnitude of school enrollments and school building needs during the 1950's.

SIMILARITY BETWEEN BIRTH CYCLES OF WORLD WAR I AND WORLD WAR II

In the realm of demography, history is repeating itself. Some vital statistics compiled after World War II are following the pattern set by similar statistics after World War I. The years following World War I were noted for many marriages and many births. The average annual number of births in Michigan during the 7 years from 1924 through 1930 was 98,634, as compared with an average annual number of 73,912 births during the 7 years preceding our entry into World War II.

As a result of the large number of births after World War I, enrollments in the public schools of Michigan exceeded one million annually during the years 1929, 1930, 1931, and 1932. The peak was reached in 1932 with a total enrollment of 1,049,505.

Similarly, the unusually large number of births following World War II will boost enrollments in the public schools of the state beyond the one-million mark again. It will probably exceed the one-million mark next year and also each year during the 1950's. It will probably attain the unprecedented figure of 1,200,000 in 1956.

The number of births in Michigan, by years, from 1920 to 1947 is given in Table 1.

TABLE 1—*Number of births in Michigan: 1920-1947**

Year	Births	Year	Births	Year	Births
1920	92,245	1930	98,882	1940	99,106
1921	96,035	1931	90,547	1941	107,498
1922	90,042	1932	85,254	1942	124,068
1923	92,956	1933	80,482	1943	125,441
1924	98,187	1934	83,944	1944	113,586
1925	98,983	1935	87,403	1945	111,557
1926	98,289	1936	88,457	1946	138,572
1927	99,940	1937	91,566	1947	160,315
1928	97,462	1938	96,962		
1929	98,695	1939	94,432		

*Annual Reports of Michigan Department of Health.

Practically all children who will be in school in 1952 will have been born in the 13-year period from 1935 through 1947 when a total of 1,438,963 were born. This is nearly a quarter of a million more births than took place during the 13-year period 1915-27. Furthermore, a constantly increasing proportion of those born survive the hazards of childhood and live to enter school. It is also quite likely that a constantly increasing proportion of children will continue in school until their graduation from the eighth grade and from the twelfth grade. It is therefore probable that the enrollment in the public schools of Michigan during the 1950's may be more than one-fifth greater than the previous maximum enrollment of 1,049,505 in 1932.

THE RISING BIRTH RATE

The birth rate is commonly expressed as the number of births during the year per one thousand population. The birth rate in Michigan in 1946 was about 24.3. This is higher than in any year since 1921. The population figures for 1940, 1930, and for other census years are known, and the birth rate for those years can therefore be readily and accurately determined. For inter-censal and post-censal years, it is necessary to make estimates of the population in order to compute reasonably satisfactory vital-statistics rates.

The State Department of Health estimates the population of Michigan for 1946 to have been 5,708,415. This estimate is based on a formula devised by Hope Tisdale Eldridge of the Population Division of the United States Bureau of the Census.[1] The estimated population of Michigan and of its counties and urban centers for 1947 has not yet been completed. However, one may tentatively assume that the growth of population in Michigan during 1947 was at least as great as the average annual increase between 1940 and 1946, which was 72,369. On this basis, the estimated population of Michigan for 1947 would be 5,780,784. This also means that the birth rate for Michigan in 1947 would be 27.5. This is the highest birth rate for any year during the past 50 years, and probably the highest in the history of the state.

The birth rate is frequently affected by the marriage rate. Between 1945 and 1946, marriages in Detroit increased 66 percent, one of the greatest increases among the large cities of the country. Mar-

[1]U. S. Bureau of the Census, Population—Special Reports, Series P-47, No. 4, "Suggested Procedures for Estimating the Current Population of Counties," April 30, 1947.

riages in Michigan reached an all-time high in 1946. This helps to explain why births in Michigan reached an all-time high in 1947.

At the moment it seems that the rising tide of births probably reached a peak last fall and one can reasonably expect the birth rate to drop during the coming months and years. But the number of children seeking admission to our schools is rising and will continue to rise for years. It is estimated that a peak of approximately 1,200,000 will be enrolled in kindergarten through the twelfth grades of our public schools in 1956. This estimate, if accurate, will be 250,000 more than were enrolled last year, and will require 8,400 classrooms with 30 pupils to a room.

ENROLLMENT IN PUBLIC SCHOOLS

The enrollment in kindergarten and in each of the 12 grades of the public schools of Michigan in 1946 and 1947 are as follows:

	1946	1947
Kindergarten	85,511	92,043
First Grade	91,442	93,544
Second Grade	84,762	84,159
Third Grade	79,052	82,749
Fourth Grade	75,684	77,363
Fifth Grade	72,828	73,895
Sixth Grade	68,982	71,554
Seventh Grade	68,525	68,735
Eighth Grade	67,100	65,284
Ninth Grade	66,417	64,079
Tenth Grade	60,616	59,292
Eleventh Grade	49,802	51,769
Twelfth Grade	41,736	45,882
Total	946,627	972,360

Most of the pupils who were in the first grade in 1946 were in the second grade in 1947, are in the third grade this year, and will be in the fourth grade next year.

In making estimates of enrollments, it is here assumed that the ratio of enrollment in the first grade in 1946 to enrollment in the second grade in 1947 will remain essentially the same year after year. Similarly, the assumption is made that the ratio of enrollment in the second grade in 1946 to enrollment in the third grade in 1947 will remain constant. The same assumptions are also made regarding the estimated enrollments in each of the other grades. Thus, the number of enrollees by grades in 1946 and 1947 serves as the basis for

estimating enrollments in grades 3 through 12 in 1948, in grades 4 through 12 in 1949, and so on for succeeding years until the present crop of enrollees will have graduated from high school by 1958.

Estimates of future enrollments in various grades can be made more accurately on the basis of pupils enrolled in the public schools of the state in 1947 than can estimates of the number of pupils who will enter school this year or in the coming years. However, the assumption in these calculations is that the ratio of births in 1941 to enrollment in kindergartens of public schools in 1947, namely 85 percent, will remain much the same during the next 10 years. On this basis, the 125,441 births in 1943 will result in an enrollment of 106,625 in kindergarten in 1949, and the 160,315 births in 1947 will result in an enrollment of 136,268 in kindergarten in 1953.

Table 2 shows the enrollment in the elementary grades, in grades nine through twelve, other enrollments, and total enrollments in the public schools of Michigan in 1930-1947, and estimated enrollments in each of these categories by years from 1948 through 1957. The table indicates that the enrollment in kindergarten through the eighth

TABLE 2—*Enrollment in the public schools of Michigan, 1930-1947, and estimated enrollment, 1948 to 1957*

Year	K—8	9—12	Other	Total
1930	838,790	166,999	20,295	1,036,084
1931	832,523	185,697	30,213	1,048,433
1932	816,494	202,215	30,796	1,049,505
1933	722,347	200,910	34,647	957,904
1934	702,903	199,506	24,973	927,382
1935	713,724	206,755	23,388	943,867
1936	709,104	214,510	28,678	952,290
1937	706,169	214,883	21,267	942,325
1938	705,171	229,383	25,273	959,827
1939	691,790	242,859	33,203	967,852
1940	683,130	248,662	41,984	973,737
1941	677,411	246,455	36,346	960,212
1942	673,723	238,478	73,438	985,643
1943	675,811	220,949	32,600	929,360
1944	685,421	211,168	30,452	927,041
1945	688,058	213,901	33,326	935,285
1946	693,886	218,571	34,170	946,627
1947	709,326	221,023	42,011	972,360
1948	740,820	213,606	38,000	992,430
1949	773,750	210,050	35,000	1,018,800
1950	792,780	209,870	35,000	1,037,650
1951	799,130	215,190	35,000	1,049,320
1952	827,150	219,410	35,000	1,081,560
1953	871,420	226,220	35,000	1,132,640
1954	903,290	230,320	35,000	1,168,610
1955	925,210	228,173	40,000	1,193,380
1956	927,480	230,770	40,000	1,198,250
1957	903,300	241,500	40,000	1,184,800

grade will steadily increase from 709,326 in 1947 to 927,480 in 1956, an increase of 218,154.

It is estimated further that the present enrollment of 221,023 in grades nine through twelve will decrease steadily for the next 3 years, reaching 209,870 in 1950, after which it will show a fairly continuous increase, rising to 241,502 in 1957. However, the peak enrollment in grades nine to twelve will probably not be reached until 1964, when the record crop of 1947 babies will be graduating from the twelfth grade.

In 1947, the number of students classified as "Others" enrolled in the public schools of Michigan totaled 42,011. It is conservatively assumed that this figure will remain about the same, that is, from 35,000 to 40,000. However, these figures will be much larger if and when the 13th and 14th grades materialize in our public school system.

Table 2 indicates that the present enrollment of 972,360 in the public schools of Michigan will increase to a figure exceeding one million in 1949, and that in 1953 and for at least 7 years thereafter it will exceed the all-time record of 1932. The peak enrollment will probably be reached about 1956, when it is conservatively estimated that 1,198,250 pupils will be enrolled in the public schools of the state. Thus, in about 8 years, if these estimates are correct, the student population pressure will be greatest and many school plants will be "bursting at their seams" unless school electors are adequately informed of their educational responsibilities to the children of their communities.

The estimates of probable enrollments in kindergarten in 1948 and in succeeding years, and estimates of the holding power of the public schools of future enrollees, are conservative for two reasons. First, the infant mortality rate will probably continue to drop, so that an increasing number of babies will survive to the age of school admittance. To illustrate, in 1940, about 95,700 babies out of 100,000 survived to the age of 5. In 1947, about 900 more per 100,000 survived to the age of 5.

Second, an increasing proportion of children in all grades in recent years have been passing into the next higher grades in successive years. This tendency can be expected to continue. Certainly the proportion of eighth-graders who enter the ninth grade should in-

crease as a result of the enactment last year of a law which requires school attendance up to the age of 16. Heretofore, thousands of rural boys and girls ended their formal schooling on completion of the eighth grade, although they were under 16 years of age.

POPULATION CHANGES BY COUNTIES SINCE 1940

The task of providing new or additional school buildings for the large aggregation of war and postwar babies will be much greater in some counties than in others. Population growth is very uneven in Michigan. In 47 counties, the population is very probably less now than it was in 1940, while in 36 counties there seems to have been some increase in population, in several of them an increase of more than 30 percent. This is the conclusion drawn from a comparison of the estimated populations of counties in 1946 with their populations in 1940.

In the 47 counties which, according to this estimate, showed a decline in numbers, the population was 1,069,437 in 1940 and only 981,718 in 1946. This is a decrease of 87,719 or 8.2 percent. On the other hand, the 36 counties which showed an increase had a total population of 4,186,669 in 1940 and 4,726,697 in 1946. This is an increase of 540,028, or 12.9 percent.

The population in Muskegon County increased from 94,501 in 1940 to 119,586 in 1946, an increase of 26.5 percent. In Washtenaw County, the population of 80,810 in 1940 increased to 106,301 in 1946, an increase of 31.5 percent. Oakland County's population of 254,068 in 1940 zoomed to 337,009 in 1946, an increase of 32.6 percent. In the relatively short time of 6¼ years (April 1, 1940 to July 1, 1946) the population of Macomb County climbed from 107,638 to 155,394, an increase of 44.4 percent. In these four counties alone, the population increased 181,273 from 1940 to 1946, and it undoubtedly increased still more in 1947. These figures give clues as to the localities where need for additional school buildings is likely to be greatest now and in the very near future. In general, there is a close correlation between total population change and changes in school census population and in school enrollments.

COMPARISON OF POPULATION INCREASE IN RURAL PORTIONS OF COUNTIES WITH THAT IN URBAN CENTERS

The question arises as to whether the need for school buildings is likely to be greatest in the rural areas or in the urban centers of those counties in which phenomenal increases in population have taken place since 1940. Answers to this question are presented in Table 3 for Muskegon, Washtenaw, Oakland, Macomb and other counties with urban centers, which show an estimated population increase of 10 percent or more.

Twenty-two Michigan counties are entirely rural, that is, they have no urban population, or no incorporated places of 2,500 or more inhabitants. Apparently 18 of them had a smaller population in 1946 than at the time the 1940 census was taken. These 18 counties are: Alcona, Antrim, Arenac, Benzie, Crawford, Gladwin, Kalkaska, Keweenaw, Lake, Leelanau, Missaukee, Montmorency, Oceana, Ogemaw, Ontonagon, Oscoda, Otsego, and Sanilac. There was an actual decrease in the total number of farms between 1940 and 1945 in 13 of these 18 counties and only a slight increase in the others. This indicates that a decline in farm population may have been the principal reason for the decrease in the total population. At least the problem of school building needs is different in these counties from that in counties mushrooming with new school enrollees.

Four other counties are also entirely rural. Two of them, Clare and Osceola, showed very slight increases in population from 1940 to 1946, while Iosco and Roscommon, the other two counties, made substantial increases. The population in the former of these two

TABLE 3—*Population increase since 1940 in specified counties*

County	Percentage Increase in Population, 1940-1946	
	Rural	Urban
Bay	10.6	9.9
Berrien	15.5	19.7
Calhoun	13.5	13.7
Clinton	10.4	7.9
Grand Traverse	12.0	10.2
Macomb	40.5	49.1
Midland	19.3	25.0
Muskegon	27.7	26.0
Oakland	47.0	21.5
Washtenaw	29.2	33.8
Wayne	11.2	11.2

counties increased from 8,560 in 1940 to 10,012 in 1946, an increase of 17 percent. The population of Roscommon during the same interval increased from 3,668 to 5,261, an increase of 43 percent.

In the 11 counties in which the total population increased 10 percent or more between 1940 and 1946, the increase was greater in the urban center or centers than in the rural areas for Berrien, Calhoun, Macomb, Midland, and Washtenaw counties, while the increase was greater in the rural areas than in the urban center or centers for Bay, Clinton, Grand Traverse, Muskegon, and Oakland counties. In Wayne County, the population increase was essentially the same for the two areas. Thus, in five rapidly growing counties, the population increase was greater in the urban areas, while in five counties the increase was greatest in the rural areas, presumably in the suburban or so-called "fringe" areas.

The only county in which the difference in population increase is much greater in one area than in the other is in Oakland County, where the population increase in its seven urban centers (Berkley, Birmingham, Clawson, Ferndale, Pleasant Ridge, Pontiac, Rochester, and Royal Oak) was 21.5 percent, while in the unincorporated or rural areas of the county, it was 47 percent. A study of 140 school districts in this county indicates that rapid population growth in recent years has been a strong contributing factor in the great variation in taxes. In 1945, property tax on $4,000 assessments when equalized, ranged from $14 to $118.[1] Uneven population changes tend to increase tax variation and inequalities in educational opportunity.

POPULATION TREND INDICATED BY SCHOOL CENSUS

Increased needs for additional school buildings, equipment, and teachers in specific school districts can be gaged by increases from year to year in the school census. According to the United States Census of 1940, 81 percent of the children of school age (5 to 19 years inclusive) in Michigan were attending school that year. Therefore, an increase in the school census within a school district from one year to the next of 37 or 38 should normally result in an additional classroom and an additional teacher to care for the enlarged enrollment. Some primary school districts in the Detroit metropolitan region increased in school population almost this rapidly annually

[1] J. F. Thaden, "Tax Variation in Oakland County and Trend Toward Equalization of Taxes by Means of Enlarged School Districts." Michigan Agr. Exp. Sta. Quart. Bul. 30: 317-338, February 1948.

during the past 10 years. The Troy-Union School District in Troy Township of Oakland County had a school census of 84 in 1936; by May 1947 this had increased to 231. During the same 11-year interval, the school census in the Southfield School District of Southfield Township in Oakland County had increased from 50 to 338, and in Brace School District in the same Township from 90 to 528. Such phenomenal increases in school census populations are taking place in scores of primary school districts adjacent to our larger cities and are likely to continue for at least another decade.

CHILDREN OF PRE-SCHOOL AGE

A law passed by the Michigan legislature in 1944 provides for the enumeration of pre-school children at the time the school census is taken. Only four other states have such a law, namely, Louisiana, Minnesota, New York, and Nevada. (In the latter state, enumeration of pre-school children is permissive.) This serves as an excellent measure for determining school budgets and equipment needs some years in the future.

The completeness of the enumeration of children by school enumerators may be determined by a comparison of their figures with the number of births from May to May as recorded by the State Department of Health. For the state of Michigan as a whole, such enumerations were 84 percent complete for those under 1 year of age for 1944, 1945, and 1946. The percentage was probably higher for those who were 1, 2, 3 or 4 years of age. The completeness of enumeration probably varies considerably but could be readily determined where school districts and vital statistics districts are coterminous or where several of one type coincide with one of the other type. Enumeration of children of pre-school age annually enables school boards and administrators to predict initial enrollments for the following September and successive Septembers and thereby make necessary plans accordingly.

SUMMARY

The wave of new school children in Michigan is not peculiar to this state. It is nation-wide. The United States Census Bureau predicts a 300,000-child increase in first-grade enrollments next September. That agency expects that the number of new school children

will roll up to a total of 3,750,000 in 1953, after which a decline is anticipated. The predicted rise and eventual decline in school enrollment in Michigan can be expected to follow much the same pattern as in all states. However, the citizens of Michigan have an advantage over those in a majority of states in the relative completeness and accuracy of annual school census enumerations, and especially in the actual enumeration of children of pre-school age. They can thereby foresee when the further strain on our school facilities will be greatest and can, if they will, prepare adequately for its arrival. It is possible to have the necessary classrooms, equipment, and teachers ready for new enrollees. To do this, educational leaders in every county and community of the state should prepare for their respective service areas tables similar to Table 2, on the basis of which plausible 5- and 10-year programs for school building and teacher needs can be wisely formulated.

TRAPS FOR THE COLLECTION AND DISTRIBUTION OF POLLEN IN ORCHARDS

By J. C. KREMER
SECTION OF HORTICULTURE

THE PROBLEM of obtaining a good set of fruit in orchards planted to one variety has always been somewhat difficult because varieties suitable for cross-pollinating are lacking in the immediate vicinity and bees and other insects are not able to spread sufficient pollen of another variety over a large area.

Several practical methods are in use today that have overcome this difficulty to some extent, but, on the whole, they are rather labo-

Fig. 1. Hive with cover removed to show typical strong colony with sufficient bees to gather large quantities of pollen and provide good pollination.

ARTICLE 31-2

rious, time-consuming, and expensive. The grafting of branches and the planting of trees of a suitable cross-pollinating variety in the orchard have provided practical solutions. Bucket bouquets in sufficient numbers have also proved effective, but they are only a temporary solution and the securing and handling of branches is considerable bother. Hand pollination, when properly performed during suitable temperatures, is quite effective, though rather expensive in the long run. The use of airplanes, pollen bombs, and water sprays as methods of applying pollen have usually resulted in failure. (Fig. 1.)

A recent addition to the above-mentioned successful methods is the use of pollen-collecting and pollen-distributing traps that employ the efforts of the bee. The principle involved is the collecting of fruit pollen from the pollen-gathering bees as they enter the hive, and conveying it to blossoms by the outgoing bees.

THE POLLEN-COLLECTING TRAP

This device is used in the hive entrance to remove the pollen pellets from the legs of the bee as it enters the hive. The trap consists of a perforated metal plate or screen 14⅜ inches by 3 inches, with 13 64-inch perforations. The measurements given are for the standard 10-frame hive and can be varied to suit 8-frame hives or others that do not conform to these lengths. It is sometimes advisable to shorten the overall length ⅛ inch to ¼ inch to allow for variation in hive width by adjusting the end blocks before fastening to the screen. Number 18- or 20-gage sheet copper is desirable, as it is non-rusting. Other metal sheeting can be used if desired, though its lasting qualities are not so good. This perforated metal screen is fastened to two triangular wooden blocks ½ inch by 3 inches by 3⅜ inches at each end of the metal screen. The screen, being 3 inches in width, leaves a space at the base of the triangle for the insertion of the pollen-collecting tray and wire screen receptacle that is used to catch the pollen pellets as they are scraped from the legs of the bee when it passes through the screen to the hive (Figs. 2 and 3).

The pollen tray should be made of 24-gage, non-rusting plated or galvanized tin that is easily crimped at the edges. The tin should be cut to 13⅞ inches by 2¾ inches, which allows for a lip or side walls ¼ inch high to form the tray. It is necessary to use a wire guard screen to keep the young bees from removing the pollen pellets that fall into

Fig. 2. Close-up view of pollen-collecting trap in position at entrance to hive. Bees cannot enter hive except through upright screen which removes the pollen pellets. Position of tray and guard screen allows ample clearance for ventilation and passage of bees.

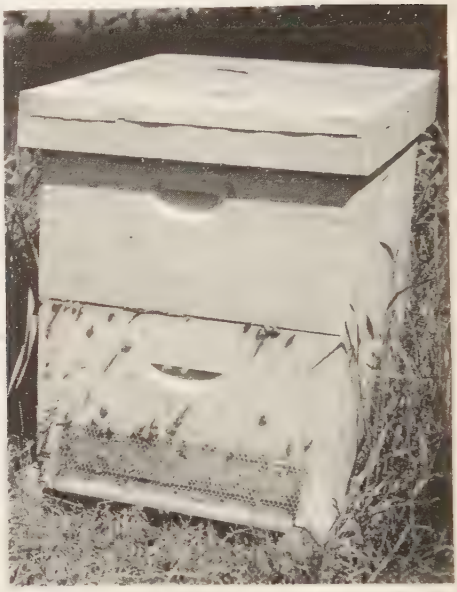

Fig. 3. Front view showing clearance behind screen and tray to entrance to hive.

the tray. They could remove the pollen if it were left unprotected. Common 6-mesh, 22-gage wire cloth cut to $\frac{1}{8}$ inch less than dimensions for the tin tray, and crimped in a similar manner, should be inverted over the tray.

PRECAUTION: 6-mesh (6 openings to the linear inch) screen **only** should be used, as anything smaller in number prevents the pollen pellets from falling through the screen, and larger mesh or openings allow the bees to rob the tray of its contents.

The position of the pollen tray should be half inside and half outside the upright collecting screen, as some pellets fall inside and some outside the screen. Sufficient space should be left between the pollen tray and hive entrance to allow for good ventilation and free movement of bees.

WHEN TO USE POLLEN-COLLECTING TRAP

For apple varieties which blossom late in the spring, such as Delicious, McIntosh, and Northern Spy, pollen may be collected from varieties that bloom earlier or precede the blooming of the variety

for which the pollen is intended. Too great a lapse between gathering and application should be avoided if necessary. The pollen-collecting traps can, therefore, be set in the entrance of the colony when the bees are placed in the orchard to service these earlier varieties, or through the entire fruit-blooming period if necessary. If the traps are properly made, no trouble should be experienced in placing them in front of the entrance. Any crevices or holes in the hive other than the screen itself will soon be discovered and used, lowering the efficiency of the trap to that of an obstruction to flight. Some confusion will exist for the first 30 minutes, but this does no harm. Though the traps obtain considerable pollen (12 to 20 percent of that collected), sufficient quantities pass through the screen for the needs of the colony.

Variations in the color of the pollen may be expected, as dandelions, wild flowers, bushes and trees may also have pollen available at this season of the year. The fact that foreign pollen is present along with the fruit pollen is also a good indication that the colonies gathering the fruit pollen are making a thorough search of all varieties of fruit bloom that may be present in the locality. This usually insures a sufficient variety of suitable cross-pollinating pollens in the mixture to offset any foreign or incompatible fruit pollen that may be present. It might be recalled that in the old-fashioned farm orchard, where nearly every apple tree was of a different variety, there was always an overlapping of the blooming period of some of the varieties at one time or another. Few pollination problems existed in such orchards, and they usually set fruit.

It might also be added that on certain days when temperatures are too low for favorable activity on fruit bloom, other blossoms such as those of dandelions will be at their optimum so that a preponderance of this foreign pollen may be found in the pollen trap. Dandelion pollen is easily recognized by its orange-yellow color as compared to the pale yellow of fruit pollen. Under these conditions the contents of the trap may be discarded, as any time spent in an attempt to eliminate it is time wasted. Inasmuch as most varieties are compatible with one another but differ as to blooming periods, a conglomeration of fruit pollen is desirable and usually acceptable for use on later varieties, providing proper precautions are taken to preserve its viability through proper handling and storage.

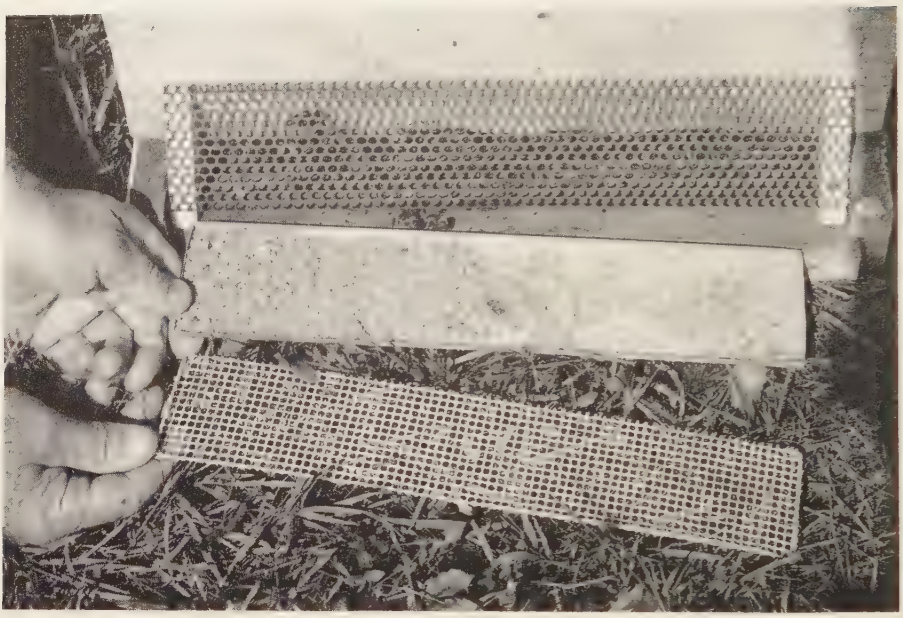

Fig. 4. Pollen tray and guard screen being removed without disturbing perforated metal sheeting. Pollen tray shows an average amount of pollen pellets obtained during several hours' use of trap.

MIXING AND STORAGE OF POLLEN

Pollen should be removed from the trays twice a day (Fig. 4.). This is accomplished by sliding the tray from beneath the collecting screen without removing the perforated screen itself. Remove the wire guard screen from the tray, pour the pollen into a container such as a fruit jar, and replace the tray in its former position. The pollen pellets should then be mixed with a diluent or carrying powder (lycopodium spores) in the ratio of about one to three parts lycopodium spores to one part pollen. This ratio should be adapted to the strength of the colony or the number of bees leaving the hive per minute, as a large number of bees passing through the mixture may create sufficient air disturbance to blow a considerable amount of the pollen mixture back in the hive if too high a ratio of the diluent is used. A starting ratio of equal parts of pollen and lycopodium spores is perhaps advisable, as more of the diluent can be added if necessary to attain the desired fluffiness for weaker colonies that do not disturb the mixture to such an extent. The color of the mixture is also a good indicator of

a proper ratio. The addition of one part pollen to one part of the very pale-yellow-colored lycopodium spores deepens the color to a pale orange.

Other diluents such as talc, cornmeal, starch, and flour are flaky in texture and when mixed with pollen have a tendency to adhere to one another in tiny lumps that prevent free flowing and distribution of the pollen grains. Lycopodium spores being dry, free flowing, and similar in size to the pollen grains, do not adhere to the pollen nor form lumps. This excellent diffusion should not be hampered by the addition of less suitable diluents in an effort to increase the amount of mixture available. As the pollen grains are easily damaged, the operation of reducing the pollen pellets in the fluffy carrying powder should be done in a gentle manner. Grinding or mashing should not be permitted. Mixing the material by hand in a bowl gives satisfactory results. A mechanical mixer can be made by fastening two 1- by 4-inch medium-soft brushes (bottle brushes) at the bottom of a small box having sloping sides and rounded bottom. The brushes should overlap. Two small wooden pulleys can be fastened to the ends and connected with a crossed rubber band. A small handle enables the operator to revolve the brushes at a moderate speed. If eight or ten

Fig. 5. The pollen-distributing trap about to be pushed in entrance of hive. The pollen and lycopodium mixture, in the form of a dust, shows the normal position it should occupy in the curvature of the metal lip.

colonies are using the traps, considerable amounts of pollen can be expected.

The pollen thus gathered and mixed should be stored under dry conditions at 34° to 36° F. if it is not to be used immediately, as it loses its viability quite rapidly, even under the best of conditions. Fruit jars make good storage containers, provided the lid is left loose.

THE POLLEN-DISTRIBUTING TRAP

The pollen-distributing trap (Fig. 5) was devised to dust the outgoing bees with the pollen previously gathered, by forcing them to scramble upward through the mixture as they leave the hive. A baffle

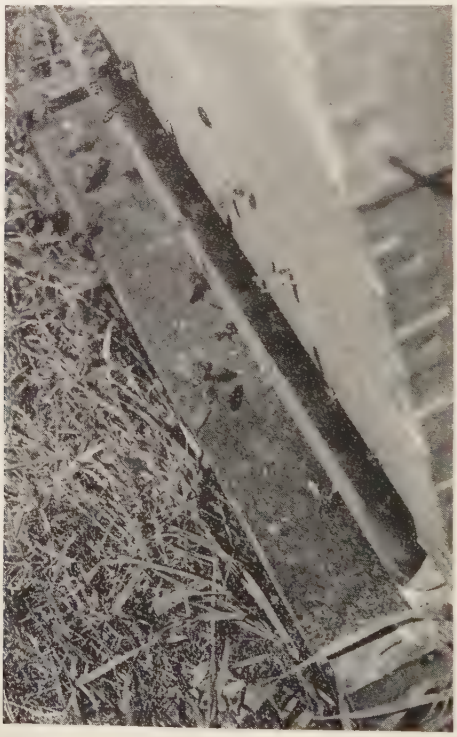

Fig. 6. The distributing trap in position after being pushed into entrance of hive. Space between hive body and metal plate should not be greater than ¾ inch to 1 inch. Incoming bees are using lower space under trap. Outgoing bees, nearest to hive, show results of dusting they received when passing through pollen mixture.

Fig. 7. Pollen mixture being sprinkled in space between trap and hive body. This should be done quickly, as indicated, from side of hive to avoid irritating bees or interfering with bee flight.

plate of sheet aluminum, or other highly-polished metal, 6 inches by 14½ inches, is bent at right angles the long way of the metal, having a curved – **not square** – center line at least an inch across the perpendicular sides. The purpose of this curve in the metal strip is to bring about the scrambling, flying motion that is caused by the narrow slippery surface between hive and baffle plate, so care should be used when bending the metal to shape. The metal plate is then fastened to three wooden strips ½ inch by ⅜ inch by 8 inches. The entrance space to the colony is ¾ inch on standard bottom boards. The metal plate divides this space to equal dimensions. The rest of the space on the wooden strips projecting beyond the tin should be covered by a 6-inch by 14½-inch wire cloth screen, having six mesh to the linear inch.

This completes the trap, and when it is placed in the entrance, the 3-inch upcurled metal plate should be within 1 inch of the front

of the hive (Fig. 6). This arrangement directs the incoming bees to the space under the trap and to the back of the hive. The outgoing bees, traveling downwards, are diverted towards the front of the hive by the screen and through the pollen mixture that is sprinkled in the curve of the tin. Not more than a teaspoonful should be distributed in the trap at one time (Fig. 7). A large salt shaker, or a can with holes punched in the lid, makes an ideal device for sprinkling the pollen mixture into the trap.

If too much pollen is added, the bees become blinded and heavy, which causes them to alight nearby to cleanse themselves of most of the pollen before continuing their flight. The rate of flight, or the number of bees leaving the hive per minute, will determine the frequency with which the pollen will have to be replaced. Package bees, with a rate of 15 to 40 bees a minute, will need much less attention than colonies flying at the rate of 150 to 250 a minute. This latter rate requires the constant circulation of an operator from hive to hive to replace the pollen as it is used.

To obtain maximum efficiency from the distributing traps, the colonies to be used for these hard-to-set blocks of fruit should not be moved to the orchard until "full bloom" and a temperature of 65° to 75° F. is expected for the day. In re-orienting themselves to the new location, the flying radius of the bees is reduced to the immediate vicinity for a day or two.

This maneuver forces the bees to pollinate the blossoms for which the pollen was intended, and not those of the surrounding countryside. If sufficient bees and traps are used for a given acreage under these conditions, 1 or 2 days should suffice to set the crop.

SUPPLEMENTARY SUGGESTIONS

It should not be assumed that the casual mention of placing the traps in the entrances of bee hives means that the operation is not fraught with some pointed possibilities when the operator is nervous, slipshod, rough, or when a strain of bees is encountered that tends to be what is called "touchy." A bee veil should be worn and a lighted smoker should be at hand at all times, as smoke is the only means of controlling the bees when they are excited. **Note:** No wool of any kind should be used as fuel for a smoker. A puff or two in the entrance before operations proceed is usually sufficient to enable the operation

to be performed in comfort and safety. Smoker and bee veil may be purchased at any bee supply company.

Lycopodium spores can be obtained from the S. B. Penick Company, 50 Church Street, New York 7, New York, or The Michigan Orchard Supply Company, South Haven, Michigan.

Arrangements have been made with the Dunkley Manufacturing Company, Lake Street, Kalamazoo, Michigan, to manufacture this equipment. It may be purchased from that company, if it is desired, though it can be made by anyone wishing to construct it.

CONSUMER PREFERENCE TESTS FOR IMITATION AND PURE FLAVORS IN ICE CREAM

By P. S. LUCAS
SECTION OF DAIRY

SCORE CARDS have been used for at least 50 years as a device for measuring quality in dairy products. These have been standardized in several states, and, for the scoring of ice cream, a maximum of 45 points is allowed for flavor. While this allowance applies to that flavor imparted to the product by agents such as extracts, it also includes the flavor, good or bad, given the ice cream by the dairy products used in the mix. It is therefore fallacious to consider the extract used in ice cream as all-important, since the heavy allowance permitted flavor on the score card must be shared by the flavor of the other products used.

Flavors and extracts are used to enhance the flavor supplied by fruit or other products. This is desirable, owing in part to the effect of cold temperatures upon the sensory nerves registering flavor. Low temperatures reduce volatilization of flavors and result in dull recording of the flavor on the nerve endings. An extract reinforces the flavor supplied by the fruit. The cost often cuts the use of optimum amounts of flavors and the same reasoning applies much more forceably to the use of fruits. The use of excessive amounts of fruits in ice cream increases the coarseness of the ice cream, cuts the cream's ability to assume overrun, and lowers its freezing point. The customary amounts of fruits to use range from 1 to 3 quarts for 5 gallons of mix.

Flavors used to reinforce fruits may be composed of materials derived from the fruits themselves, in which case they are referred to as true fruit extracts, or they may be composed of synthetic products and mixtures of oils, ethers, chloroform, alcohol, etc. The flavor of the fruit is usually contained in the essential oil of that fruit. To date, some 10 to 14 known ingredients have been isolated, each of which

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modifies and blends with the other individual ingredients. Many different flavors contain the same ingredients but in different proportions. In this study, an answer was sought as to whether the public prefers a pure flavor or an imitation flavor in ice cream. The search was limited to two flavors, vanilla and strawberry.

VANILLA

The taste of vanilla extracts depends largely upon the locality in which the vanilla bean was grown. According to the United States Pharmacopeia, a single-strength vanilla must contain the extractive matter from 13⅓ ounces of beans per gallon. Stronger extracts may be made, usually in multiples of the amount used in single strength, and are referred to as concentrates. These are pure extracts, whether of single or multiple strength. An imitation flavor, according to the standards, is one made up entirely of synthetics or of pure vanilla with reinforcement, as with added vanillin and coumarin. In this report, only pure and imitation liquid extracts were used, although powdered flavors and emulsions are on the market.

Isolated in 1860 by German chemists, vanillin has a wide usage in flavors. Its flavor somewhat resembles that of vanilla. It is found in all vanilla beans and is partially but not wholly responsible for vanilla flavor. It may be made synthetically from oil of cloves, coniferin, or sulfite liquor, and is used frequently to reinforce vanilla extracts and to make imitation vanilla. The so-called Tonka blend vanilla is made by adding to vanilla extract the extract of the Tonka bean or by the addition of synthetic coumarin, which is the flavoring principle of the Tonka bean. It lends an aromatic flavor but does not closely resemble vanilla. This modification is said to be used chiefly in the South, although before the passage of the flavor law, it was used in Michigan. Either of these two synthetics, when added to pure vanilla, greatly increases the flavoring power of the vanilla. Formerly it was claimed that pure flavors would freeze out of ice cream and that the addition of these synthetics would prevent this. That claim has been disproved, however.

TESTS WITH VANILLA

Ice cream was prepared with five types of vanilla. These types and the amounts used for 5 gallons of mix were as follows:

1. Pure Mexican-Bourbon bean extract, 4 ounces.
2. Pure vanilla reinforced with vanillin, ¾ ounce.
3. Fortifier, 4 ounces.
4. Pure concentrated vanilla reinforced with ¼ ounce coumarin per gallon.
5. Imitation vanilla, 2 ounces.

Number 1 contained the extractive matter from 60-percent Bourbon beans and 40-percent Mexican beans. Number 2 was a Bourbon and Mexican bean concentrate containing 1 ounce of vanillin per gallon. Number 3 was an imitation composed of vanillin, St. John's bread, ethers, esters, gum, coloring, alcohol, and glycerine. Number 4 was a concentrate of combined Bourbon and Mexican beans containing 1 ounce of coumarin per gallon. Number 5 was an imitation made up of the same materials as number 3 but in different proportions.

The ice creams were made from the same mix and were of a standard such as is commonly used in this state. A sample of each was placed on a paper plate with a number. These plates were passed out to individuals together with a slip of paper, and they were asked to carefully sample each one by themselves and to rate them according to quality. They were asked to do this individually to eliminate the possibility of their being influenced by the opinions of others. While it is doubtful that these scorers gave the matter as careful attention as would a trained judge, it is believed that in most cases a considered opinion was given.

Forty-four persons sampled each of the five types. A record was kept of the number of people placing each type first, second, third, fourth, or fifth. This is referred to as its placing. Each placing was then rated by multiplying the number of people placing it by the placing itself. Thus, if three people placed number 1 sample fourth, the three was multiplied by four to get the rating. That sample having the lowest rating, therefore, would rate first. These ratings are reproduced in Table 1.

The number 1 sample, which was pure vanilla, easily placed first with 114 points. The number 5 sample, imitation vanilla, placed second with 128 points. The number 2 sample, which was pure vanilla reinforced with vanillin, placed close to the number 5 sample, with 134 points. The number 4 sample, which was pure vanilla reinforced

TABLE 1—*Results of scoring vanilla ice creams*

Rating	Sample number 1		2		3		4		5	
	Judges so rating	Total score	Judges so rating	Total score	Judges so rating	Total score	Judges so rating	Total score	Judges so rating	Total score
First	11	11	13	13	5	5	5	5	10	10
Second	13	26	5	10	10	20	8	16	8	16
Third	10	30	5	15	6	18	14	42	9	27
Fourth	3	12	9	36	14	56	8	32	10	40
Fifth	7	35	12	60	9	45	9	45	7	35
Total	44	114	44	134	44	144	44	140	44	128

with coumarin, was a poor fourth and the number 3 sample, which was a fortifier, placed last.

These tests were made entirely by the general public and they would indicate that there are many people who dislike imitations. It would perhaps not be too farfetched to conclude that people like those products to which they have become accustomed. In the pastry industry, many imitation flavors are used, and many imitation flavors are sold to the housewife for use in the home. It is perhaps not too far from the truth to say that a good imitation may be better than a poor extract. A pure extract may be made from Tahiti beans which will yield a flavor characteristic of the vanilla extract but inferior to many good imitation flavors. The results of the scoring, however, show that a majority of the people prefer a pure extract so far as vanilla is concerned and that the manufacturer of ice cream hoping to stay in business will probably find the use of a pure extract to be more economical than use of an imitation flavor in the long run. He will find it still more profitable if he extensively advertises the fact that he uses nothing but pure flavors. It is a goal which the larger, more progressive manufacturers have set as their aim and toward which they direct their advertising.

TESTS WITH STRAWBERRY

Following the procedure described in studying vanilla extracts, the public taste regarding strawberry flavorings was scrutinized.

The following extracts were added to a strawberry ice cream containing 3 quarts of strawberries for 5 gallons of mix. Such an extensive

use of fruit, it is realized, would make less noticeable the type of strawberry extract used to reinforce the flavor and might therefore make less noticeable differences between the types used.

1. True fruit strawberry extract, 3 ounces.
2. A second true fruit strawberry concentrate, 1 ounce.
3. A strawberry flavor, single strength reinforced, 3 ounces.
4. Imitation strawberry flavor, 2 ounces.
5. A special imitation strawberry, 3 ounces.

Number 1, listed as a true fruit strawberry, actually contained 75 percent true fruit strawberry plus 25 percent true fruit raspberry. Both of these ingredients were concentrates. The second was also a true fruit strawberry concentrate. Number 3 contained a natural strawberry concentrate reinforced with a natural raspberry concentrate. Number 4, the strawberry imitation, contained imitation oil of strawberry, natural oil of lemon, ethers, natural raspberry concentrate, and alcohol. Number 5, a special formula imitation, contained natural raspberry concentrate, imitation oil of strawberry, oil of orris, other essential oils, vanillin, acetic and other ethers, esters, aldehydes, sugar, glycerine and propylene glycol.

The scores obtained in judging the strawberry flavorings were divided, according to the judging personnel, into two classes, experienced and inexperienced. Scoring was done in a manner identical with that for vanilla. The latter, inexperienced scorers, placed number 1 sample, pure strawberry, with a score of 56, first. Number 2 sample, pure concentrate, rated second with a score of 67. Number 3, pure reinforced, scored 68. Number 4, imitation, scored 75 and number 5 placed last. This form of rating, it should be stated, places samples closer together than would a straight score card method of rating.

Since the scorers were inexperienced, however, it was impossible to use a rated scale such as given on the score card. Twenty-three inexperienced scorers were used to compose the inexperienced group. Fifteen scorers composed the experienced group. Their placings were 1, 3, 2, 4, 5, whereas that of the inexperienced group was 1, 2, 3, 4, 5. The scores given by the inexperienced group were respectively 32, 44, 45, 49, 55. Numbers 2 and 3, therefore, were extremely close and for all practical purposes, the rating of the two groups of scorers was the same. It will be noted that the imitation samples placed a poor

fourth and fifth. Since number 3 contained no imitation products but rather a true fruit strawberry flavor reinforced with a true fruit raspberry flavor, the placing made by experienced judges is not surprising. Placing of this material over number 2 by one point only would suggest that the blend of true fruit materials was a very good one.

The results of this study in Michigan, where the use of pure flavors has been required for several years, show a much greater appreciation of a flavor true to the fruit represented than would be expected. It should be a source of encouragement to manufacturers seeking to manufacture the best possible ice creams.

TREE PLANTING ON CLAY SOILS

By M. W. DAY and T. C. NELSON
Dunbar Forest Experiment Station

While most tree planting is done on the lighter soils, occasionally it is desired to establish plantations on the heavier soils. A planting experiment at the Dunbar Forest Experiment Station has been especially concerned with the species and methods that should be used to establish trees on an Ontonagon clay soil, typical of much of Chippewa County. Areas with these soils usually have many farms without adequate windbreaks.

The site of this experiment was a field of Ontonagon clay which had been under cultivation for a number of years but had been in grass sod for about 10 years. A portion of the field had been planted to spruce a number of years before with poor results. This may be attributed in part to the lack of aeration in the soil and in part to low water availability. This in turn was due to a low absorption rate, deep cracking, retention of light precipitation in the upper soil layer and a high wilting coefficient. Thus a fine-textured, impervious soil is much less suitable for tree growth than is a lighter soil, as has been demonstrated by Stoeckeler and Bates (1).

The area where the experiment was conducted has a high water table during the early growing season. Measurements of the height of the water table during the month of June varied from 4 inches to 2 feet below the ground surface. Such a condition makes planting rather difficult and requires care in the use of equipment to avoid packing or puddling the clay.

The field had a heavy sod ground cover and produced a rank growth of grasses and sedges during the early summer. This vegetation provided serious competition for planted trees and was another factor contributing to poor survival in plantations on these sites.

The problem resolved itself into one of finding species best able to cope with the adverse soil and moisture conditions, and at the

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same time finding some practical method of ground preparation and planting that might in some degree overcome the handicaps of the site.

To secure adequate aeration, it was first necessary to remove excess surface water by surface drainage ditches. Mound or ridge planting has also been advocated as a means of securing better aeration and drainage (2, 4). Most mound planting is done by European hand methods and is too expensive for use in this country. However, it was felt that some form of ridge was necessary, and an attempt was made to prepare ridges with a tractor, plow and disk harrow, implements available to most planters.

By plowing two or more furrow slices together, a ridge may be formed that will be somewhat higher than the general level of the ground. On clay sod-land it is then usually necessary to go over the

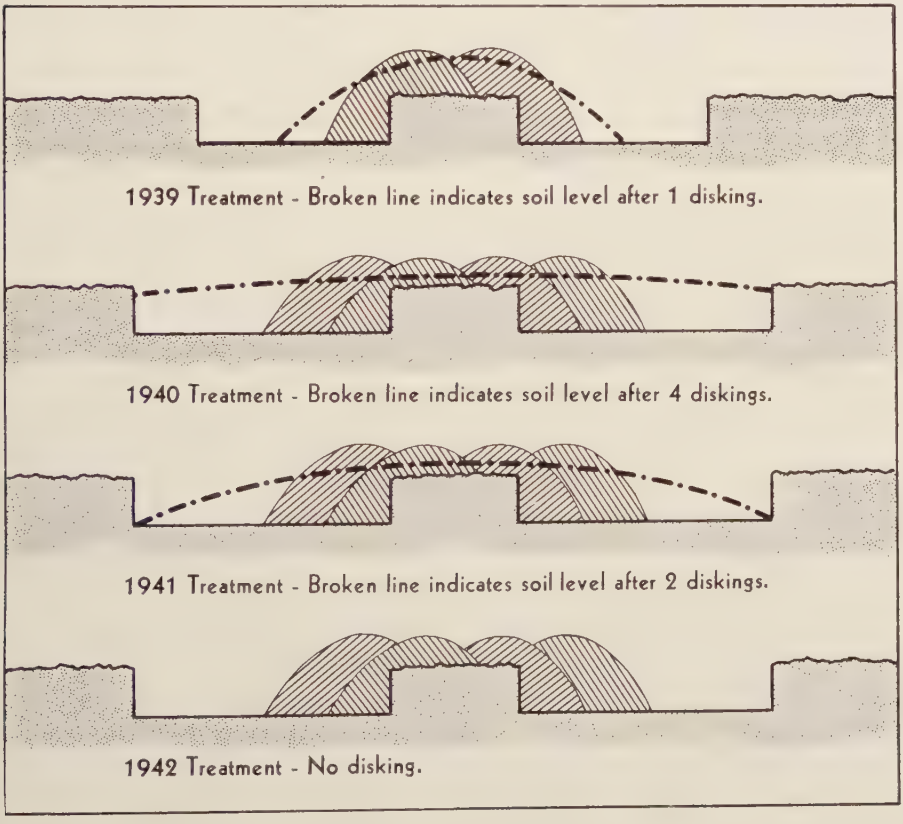
1939 Treatment - Broken line indicates soil level after 1 disking.
1940 Treatment - Broken line indicates soil level after 4 diskings.
1941 Treatment - Broken line indicates soil level after 2 diskings.
1942 Treatment - No disking.

Fig. 1.

ridge at least once to smooth it and reduce air spaces, which cause the soil to dry out prematurely. If planting is delayed long enough to allow the ridge to settle naturally, better planting conditions will result but grass competition will be increased. The methods used during the 4 years are illustrated in Fig. 1, which shows the ridges plowed and after disking. The time of treatment is also indicated.

The 1942 planting was on land that had been kept fallow one season previous to being plowed into ridges. This treatment resulted in the best relief, best planting conditions, and the least vegetative competition during the first growing season.

Since the object of the ground preparation was to increase the soil aeration around the planted trees as well as to reduce the vegetative competition, the 1942 method seemed to accomplish this objective best. Fall plowing, followed by one disking in the spring when soil moisture is such that puddling of the soil will not occur, seems to be the minimum treatment that can be used to obtain good planting conditions and still reduce the vegetative competition sufficiently to allow the trees to establish themselves.

The experiment was carried on in accordance with the plan devised by Wakeley and Chapman (3), except that lack of nursery stock prevented duplicating exactly the same species each year. The area was laid out in a series of randomized blocks designed to insure the reliability of the results obtained.

All planting was by the deep-hole method, using shovels. Each block was planted entirely by a single planter. The date of each planting was chosen for similarity of weather conditions, but some variation was unavoidable here.

RESULTS

The five species used throughout the entire test, white pine (*Pinus strobus*), red pine (*Pinus resinosa*), balsam fir (*Abies balsamea*), green ash (*Fraxinus pennsylvanica* var. *lanceolata*), and white spruce (*Picea canadensis*) were analyzed as a group. The other species used in the study were compared insofar as possible with the data at hand. All data regarding the studies of survival and vigor have been subjected to analyses of variance, and the conclusions drawn are statistically sound.

As shown in Table 1, the 1939 treatment proved to be less successful than the other three treatments. The soil preparations in the

TABLE 1—*Percentage of trees that survived the first growing season*

Species	Year planted			
	1939	1940	1941	1942
White pine	92	84	95	95
Red pine	98	94	79	97
Balsam fir	31	98	97	91
Green ash	98	99	88	92
White spruce	55	82	99	97

other three years were equally successful so far as initial survival is a criterion. Balsam fir and white spruce had lower survival percentages than the other three species. White pine, red pine, and green ash showed no difference in their survival percentages.

The survival count 5 to 8 years after planting follows trends similar to those observed after the first growing season (Table 2). Although there is no difference between species, both the 1939 and 1940 treatments, the treatments with the least ground preparation, are inferior to the 1941 and 1942 treatments.

Species were graded, according to vigor, in six classes: very thrifty, thrifty, growing, growing poorly, failing, and almost dead. However, in view of the probability that the top three vigor classes would include an increasingly higher percentage of the stand as it matured, the data from the top three vigor classes (very thrifty, thrifty, and growing) were pooled and presented as criteria for the vigor of the plantings. As a safeguard against erroneous conclusions, the data from all the vigor classes were analyzed. The conclusions from these analyses were essentially the same as those formed from the analyses of the top three vigor classes.

Table 3 shows that the species were equal in initial vigor. The 1939 and 1941 treatments were not so successful as the 1940 and 1942 treatments.

TABLE 2—*Percentage of trees that survived to August 1947*

Species	Year planted			
	1939	1940	1941	1942
White pine	71	58	72	70
Red pine	79	47	57	54
Balsam fir	15	80	82	62
Green ash	41	10	60	77
White spruce	48	64	83	84

TABLE 3—*Percentage of total trees planted included in the top three vigor classes at the end of the first growing season*

Species	Year planted			
	1939	1940	1941	1942
White pine	80	77	75	79
Red pine	97	84	30	93
Balsam fir	20	97	82	63
Green ash	90	95	47	83
White spruce	51	73	74	84

The 1939 planting showed very little success with balsam fir. No plausible explanation is offered. The 1941 red pine and green ash indicate reduced vigor. Thirty-seven red pine were classified as "growing poorly" and thus are not included in the tabular presentation of data. A summer frost accounted for the decreased vigor of green ash.

TABLE 4—*Vigor of planting as of August 1947, as expressed in percentage of total trees planted*

Species	Year planted			
	1939	1940	1941	1942
White pine	69	56	71	52
Red pine	74	46	57	52
Balsam fir	13	74	76	57
Green ash	7	1	37	67
White spruce	45	62	83	75

As shown by Table 4, the subsequent vigor of green ash was less than that of other species. No difference was noted between the vigor of the other four species. The 1939 and 1940 plantings were inferior to those of 1941 and 1942.

Scots pine *(Pinus sylvestris)* and jack pine *(Pinus banksiana)* were tested in two year's planting. Although jack pine had a slightly lower survival rate than Scots pine, it proved equal in other respects. Considering both survival and vigor, white pine, red pine, Scots pine and jack pine were equal.

TABLE 5—*Percentage of white and black spruce surviving after first growing season*

Species	Year planted		
	1940	1941	1942
White spruce	82	99	97
Black spruce	83	95	98

A comparison of white spruce with black spruce (*Picea mariana*) showed a high degree of similarity (Table 5).

Norway spruce (*Picea Abies*) was also compared with white spruce in the 1939 treatment and found to be identical in survival and vigor percentages.

Attempts to establish game food species such as elderberry (*Sambucus canadensis*) and mountain ash (*Sorbus americana*) were unsuccessful. All specimens died within a 7-year period. Red-osier dogwood (*Cornus stolonifera*) and northern white cedar (*Thuja occidentalis*) were somewhat better, having a 26-percent and 28-percent survival respectively 7 years after planting. However, these species need further tests before recommendations for them should be given on heavy clay sites.

TABLE 6—*Percentage of hardwood species surviving after 6 years of growth*

Year planted	Basswood	Yellow birch	American elm	Green ash
1941	57	2	84	60

Yellow birch (*Betula lutea*) planted in 1941 proved unsuccessful. Basswood (*Tilia glabra*), American elm (*Ulmus americana*) and green ash were equally successful (Table 6). White ash (*Fraxinus americana*), black ash (*Fraxinus nigra*), and green ash were very similar in survival and vigor in 1939 plantings. However, a frost on July 9, 1947 was less severe on black ash than on white ash and green ash. This accounts for a more vigorous appearance of the black ash. The frost damage to all three species makes their use questionable. Russian olive (*Elaeagnus angustifolia*) plantings were unsuccessful.

Growth was not measured, but a survey of the general appearance of each species indicated that jack pine had made the best growth, followed by Scots pine. The other species were considerably smaller and more uniform in growth, with balsam fir and the other pines all making satisfactory growth. Those hardwoods that were successfully established were growing satisfactorily, but slower than on more protected sites. For windbreak plantings where rate of growth and growth habit must be considered as well as survival, it seems that jack pine, Scots pine, white spruce and black spruce are best adapted to planting on these soils in northern Michigan.

These experimental plantings indicate that reforestation can be

successful on heavy soils if the ground is properly prepared. The 1939 and 1940 plantings, however, proved less successful than those in 1941 and 1942. The essential ground preparation on this soil seems to consist of adequate surface drainage, construction of ridges for the trees to be planted on, and some reduction of the competition from grass and other vegetation.

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OBSERVATIONS ON ROUGH OR "SPOTTY" HOMOGENIZED MILK

By G. M. TROUT and J. ROBERT BRUNNER
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RECENTLY, samples of rough or spotty homogenized milk were brought to this laboratory for investigation. This paper reports briefly the results of the study made on these samples and on the processing of the defective milk.

NATURE OF NORMAL HOMOGENIZED MILK

Homogenized milk properly processed and handled is smooth and homogeneous. This characteristic manifests itself in the partially emptied glass or bottle. When some of the milk is poured out, the film left behind on the glass drains so well that the glass appears clean above the milk-surface line. Probably the same capillarity which results in seepage (5) is responsible in part for this superior drainage from the glass surface. Regular users of homogenized milk come to appreciate the clean appearance of the glass in contrast to the greasy film commonly observed on the inner surface of a partially emptied glass of nonhomogenized milk. Consequently, any roughness, spottiness or lack of smoothness within the milk as revealed on the surface of the glass is likely to bring complaints from customers. In such cases, a check on the bottled milk itself may reveal a ring-like film on the surface adjacent to the glass, or may show foam adhering to the bottle closure. This film is dissimilar to that produced by cream which sometimes appears on inadequately homogenized milk, is light in color, lacks smoothness, and seems to be more characteristic of precipitated milk protein.

DESCRIPTION OF THE ROUGH, SPOTTY HOMOGENIZED MILK

Examination of the bottled milk having this defect showed the milk to have a normal viscosity unlike that previously reported (2),

ARTICLE 31-5

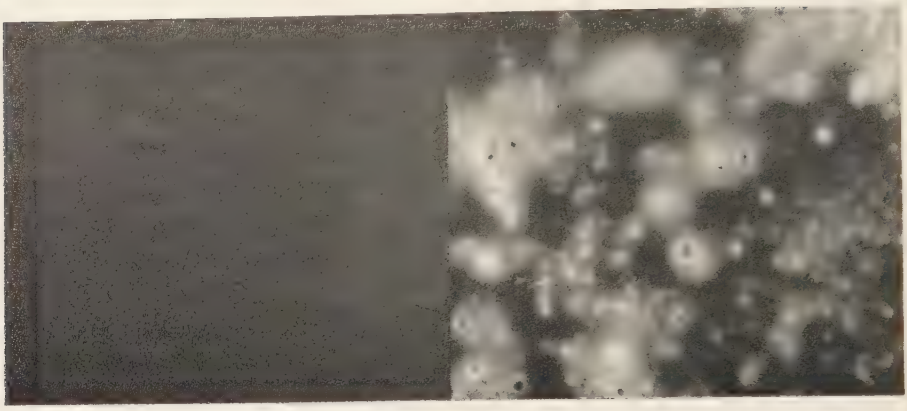

Fig. 1. Normal (left) and abnormal (right) films remaining on the inside surface of milk bottles of homogenized milk as the air-space bubble is rotated by tilting the container and turning the bottle slowly. Magnified about two and one-half times.

but a rough, slightly granular foam was found adhering to the under side of the cap. At the milk surface adjacent to the glass was a narrow ring of loose, cream-like material extending out from the glass about one-eighth inch. Upon tilting the closed container, this substance seemed to follow the air-space bubble leaving deposited on the glass tiny specks, as shown in Fig. 1. The specks appeared larger than they actually were inasmuch as capillarity drew and attached to them some milk. When the milk was poured from a glass, the soiled-glass surface presented a particularly rough, curdy appearance. Children associated this roughness with the milk and in some instances actually refused to drink it.

Further examination of the milk under a stereoscopic microscope with 42.5× magnification showed the presence of many semi-translucent spherical pellets. These pellets varied in size, the larger ones being barely macroscopic. Intermixed was considerable solid material, amorphous in character, thought to be chiefly protein which probably resulted from collapsed air-cell walls, since the defect was associated more or less with foaming. By means of a needle the spherical pellets could be moved intact from the liquid surrounding them to the dry area of the glass slide, where they could be studied separately. Here they appeared gelatinous and sticky and spread under pressure, offering little resistance. After some exposure to heat, the serum surrounding the pellets dried, and the pellets them-

selves flattened as the semi-solid material changed into a translucent liquid. The oily liquid readily took the fat-soluble dye, Sudan III. All observations indicated that the tapioca-like pellets causing the trouble were fatty in nature. However, fat tests from top and bottom portions of the sample showed the milk to be well homogenized. In fact, in analyzing homogenized milk exhibiting considerable fat rising, the writers had never before encountered such a defect as that reported herein. The pellets were well out of the microscopic micron size of fat globules and approached the macroscopic granule size.

INVESTIGATION OF THE CAUSE OF THE DEFECT

Sequence of Processing

The sequence of processing the defective milk consisted of clarifying, preheating, homogenizing, high-temperature short-time pasteurizing, cooling, and bottling. The processing system was essentially a closed system except (a) during homogenization, when the milk was conducted from the preheating section of the pasteurizer to an open surge tank from which it entered the homogenizer, and (b) in the surge tank ahead of the bottlers. Considerable foam gathered at the surface of the milk in the surge tanks. However, a sufficient head of milk was maintained so the macroscopic foam could not be occluded in the milk. Nevertheless, there was a possibility that some air might have been homogenized into the milk giving rise to a microscopic foam. From the pasteurized milk surge tanks to the bottlers was a distance of approximately 15 feet and a drop of about 6 feet. Two fillers, a vacuum and a gravity-flow, were used. Some difficulty was encountered with foam in filling the bottles by either machine, but the rough, spotty defect appeared worse in the milk filled with the vacuum filler.

Routine Microscopic Examination of the Milk at Various Steps of Processing

Inasmuch as the gelatinous, tapioca-like pellets were always observed in the rough-appearing homogenized milk and seemed to be foreign to that product, inquiries were made to ascertain whether a stabilizer or any other foreign substance might have been added. Such was not the case. A detailed routine microscopic examination

TABLE 1—*Examination of milk at various stages of processing*

Nature and source of sample	Presence of pellets in the sample*
Raw, holding tanks	–
Raw, beyond clarifier	–
Raw, preheated	–
Raw foam, surge tank ahead of homogenizer	–
Preheated, homogenized	–
High-temperature short-time pasteurized	–
Pasteurized, cooled	–
Foam on pasteurized milk surge tank	–
Milk at entrance to filter reservoir	–
Bottled milk	–
Vacuum filler	–
Gravity filler	–

*Key —No pellets present.
+Pellets present.

was made of the milk at various steps of processing. The results are shown in the accompanying table.

From the data in Table 1 it should be noted that the pellets causing the difficulty were not observed during the various stages of processing until the milk reached the filling machines. Examination of the milk in the filling machines showed the presence of a rough, granular, swirling foam, portions of which evidently were being entrapped with the incoming milk and hence carried into the bottles. This foam was heavily seeded with the pellets in question.

Realizing that properly homogenized milk cannot be churned except by prolonged rigorous agitation and then only in part, an investigation was begun to ascertain how the pellets came to exist in the filler reservoirs. Evidence pointed to the fact that nonhomogenized fat had been introduced into the reservoirs prior to bottling the homogenized milk. Upon questioning the operator at the bottle-filling machines, it was learned that prior to bottling homogenized milk, whipping cream, table cream and half-and-half were bottled. No attempt was made to rinse out the bottle-filling machines between filling operations. Examination of the whipping cream, table cream and half-and-half revealed the presence of the tapioca-like, fatty pellets characterizing the defective milk. A complete dismantling of pipes and a thorough clean-up after bottling the nonhomogenized products eliminated the cause of the rough or spotty texture of the homogenized milk.

DISCUSSION

Too much emphasis cannot be placed on the necessity of having properly homogenized milk free from contamination with a non-homogenized product if the bottled product is to remain smooth and free from a cream layer of fatty particles. Likewise, foaming must be kept to a minimum, for it may result in partially filled bottles (4) and in a concentration of milk solids resulting from the presence of denatured proteins. Because solid materials migrate to the foam film, more solids exist in the foam than in the liquid from which the foam was derived. Consequently, the collapse of these air cells results in a flaky concentration of denatured milk solids at the surface. Presumably, this is the "Ramsden phenomenon" (3) as suggested by Davies (1).

Much experience has been gained during the last score of years in processing and handling homogenized milk. It seems, however, that the necessity for special precautions in treating homogenized milk is not yet fully appreciated.

SUMMARY

An instance of a rough, spotty homogenized milk causing consumer complaints was found to be due chiefly to the presence of tiny spherical butterfat granules coming from creams bottled prior to bottling of the homogenized milk without cleaning the equipment. The defect was attributable in part to foaming.

Dismantling and cleaning the equipment after bottling the non-homogenized product eliminated the condition causing the defect.

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TIME STUDY OF SMALL SAWMILL AIR DOGS

By J. W. CREIGHTON

SECTION OF FORESTRY OF THE MICHIGAN AGRICULTURAL EXPERIMENT STATION AND THE LAKE STATES FOREST EXPERIMENT STATION OF THE U. S. FOREST SERVICE COOPERATING

IN FEBRUARY 1947, a report, "Air Dogs for Small Sawmills," was published in the *Michigan Agricultural Experiment Station Quarterly Bulletin*, and in September 1947, blueprints of the air dogs were made available. Considerable interest in these air dogs was aroused, but there was some question in the minds of sawmill operators as to the value of the dogs to their particular operations. It is the purpose of this report to indicate what value the dogs have in the L. L. Johnson Lumber Co. sawmill at Charlotte, Michigan, where they have been in continuous operation over a period of time. The basis of the report is a time study of a sample of 498 logs, half of which were sawed using only hand dogs and the other half using air dogs. This sample and the conditions under which it was sawed may be assumed to be reasonably representative of the milling operation at this sawmill. The results, therefore, could be applied to a yearly operation with an expectation of reasonable accuracy.

It does not necessarily follow that the savings effected in the L. L. Johnson sawmill will be duplicated in other mills. Work habits within different mills and with different sawyers and block setters are so variable that it is impossible to apply the results of a time study in one mill to another even though the same class of equipment is used and the same number of men is employed. Also, grades of logs and quality of lumber cut from the same log grades vary so widely that the monetary value to a sawmill of the air dogs can be appraised only by arriving at the monetary value of a sawing minute for that particular mill and applying it to the time saved. The results at the Johnson mill can, therefore, be used only to estimate possible savings in other operations.

ARTICLE 31-6

DESCRIPTION OF OPERATION

The Johnson sawmill is a 6-foot band mill with a three-headlock carriage driven by a twin-engine steam feed. The crew consists of a combination pond and deck man, a block setter who rides the carriage alone, a sawyer, an off-bearer, and others to edge, trim, and handle lumber. However, only the block setter and sawyer directly affect the operation insofar as the time study is concerned. Logs are hauled into the mill from the log pond by the jack chain and rolled off the chain to the log deck by a bull chain. The log deck is only slightly sloped, as there is no stop and loader, so logs must be rolled down the deck by the deck man. The mill is equipped with a friction nigger to turn logs.

Sawing at the mill is for grade as much as possible, and all logs with the exception of an occasional extremely crooked or knotty one are sawed as shown in Fig. 1.

Obviously the air dogs would affect the time consumed only during the loading, unloading or turning of the log. These operations were, therefore, broken down into the following elements: Undogging, turning and taper setting, dogging, reaching position to set,

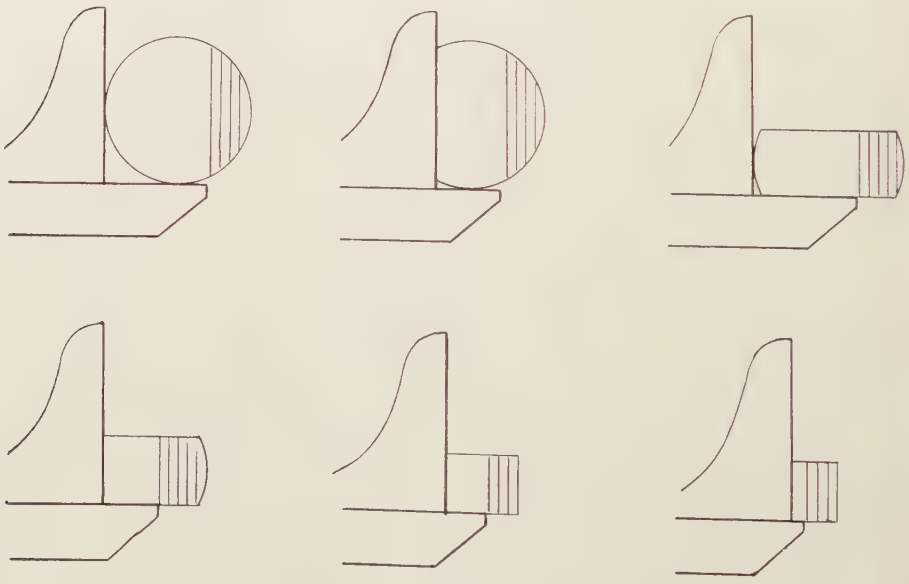

Fig. 1. Log positions.

TIMING POINT	ABBREVIATION	EXPLANATION
Undog	U	Time of first motion to undog logs.
Undog completed	UC	Time log is free of dogs and can be turned.
Dog	D	Time of first motion to dog.
Dogging completed	DC	Time dogs are set and block setter is free for his next operation.
Set	S	Time of first motion to set log for sawing.
Set completed	SC	Time log is in position on carriage for cutting. In most cases this is the time at which the sawyer signals the block setter to stop setting.
First saw cut	C	Time saw first touches log for each new log position.

Fig. 2. Element timing points.

setting, and feeding to cut. Timing points bounding these elements are shown in Fig. 2.

In making the study, times for each log were recorded on separate forms (Fig. 3). Time figures were placed above the dotted line for each timing point, leaving room for the difference between the points or the element time below the dotted line. The difference between U and UC is the undogging time, the difference between UC and D is the turning time, between D and DC the dogging time, between DC and S the time to reach position to set, between S and SC the setting time, and between SC and C the feed to cut time. Where no dogging time was consumed in the turning operation, the difference between UC and S would then be the turning time. A minute decimal watch was used giving time in minutes and hundredths of a minute. For ease of recording, the watch was brought back to zero before each turn.

In loading the logs there is no undogging operation, so the first series of times starts with the first motion to dog. Normally each timing point must be recorded for the turn to the second log position. It will be noted that in only these two operations is any time charged against the block setters reaching position to set. This is typical of all logs dogged pneumatically because in these two positions the block setter must step forward on the carriage to hold the log against

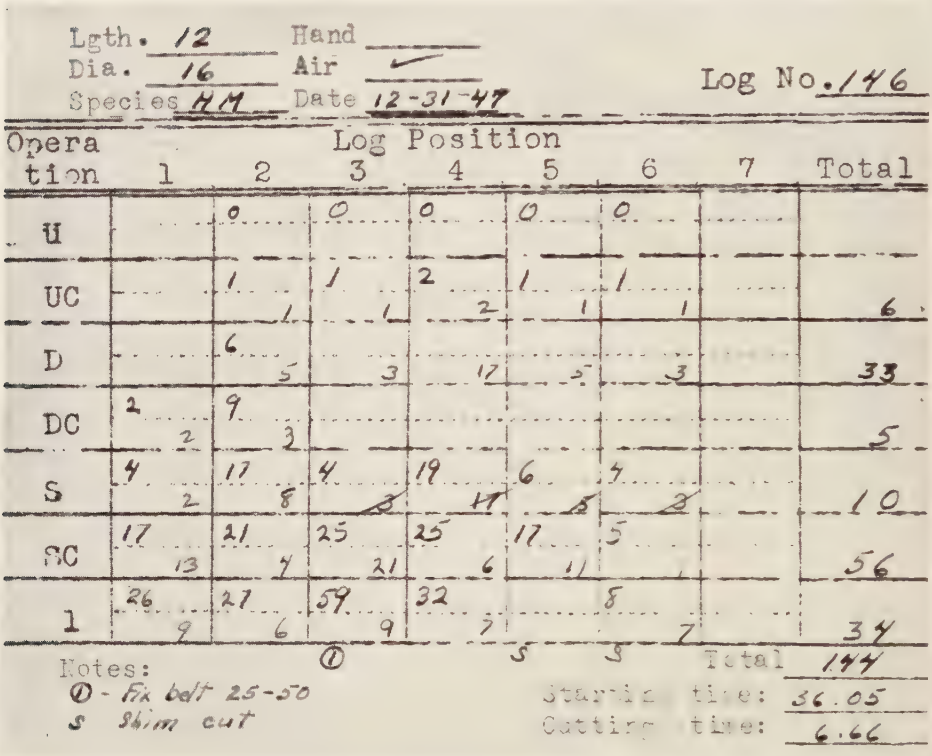

Fig. 3. Element time data form.

the knees for dogging. In log positions where there is a flat face down, the block setter need not leave his position and therefore is ready to set at any time.

It will be noted that, starting with the third position, no time is recorded for dogging. This does not mean that the log is not dogged in these positions but that dogging is accomplished during another operation so no time can be charged against it. Usually the air dogs are set during the motion of the carriage to the cut or while the saw is actually cutting. This cannot, of course, be done with the hand dogs for safety reasons so time must be charged against each hand dogging operation. In any position in which no dogging time is taken, lower S would then be the turning time. As is shown in Fig. 3, this time was crossed off and elevated to line D for ease of computing total turning time.

The dogging procedures are somewhat different when hand dogs

are used. Since the block setter must step forward on the carriage to undog, he waits there for the log to be turned before returning to setting position. Time is, therefore, chargeable to both dogging and the return to setting position except in the infrequent instances when these elements of the operation can be performed on free time produced by the sawyer.

After logs have been squared, the first cut in the new log position for both the hand and air operations is very often a shim cut to straighten out crook in the cant. For the shim cuts, the sawyer does not wait for the log to be set but feeds the log up to the saw during the setting operation. The setting proceeds until the time the log touches the side of the saw, so no time is charged against feeding to cut. For some positions no initial setting is required, so all the time was charged against the feed of the carriage up to the saw.

COMPUTATION

Data forms were first sorted by species, diameter and length. A comparison after sorting showed that, as one would expect, the average total sawing time, per log, varied according to species, length, and diameter. However, only the time of saw and gig back varies between length classes and between species for a given diameter, and the time to undog, turn, dog, set, and feed to cut remains constant. Since only these element times are affected by the air dogs, and since they remain constant for any given diameter provided the same dogs are used, it is unnecessary for purposes of this study to break down each diameter by species and length. If there were a wide discrepancy between the number of logs in each species and length sawed using hand dogs and those sawed using air dogs it would be re-

TABLE 1—*Number of logs by species*

Species	Operation		Total	Percentage of total
	Hand	Air		
Hard maple	111	116	227	45.6
Beech	53	50	103	20.7
American elm	42	40	82	16.5
Basswood	22	20	42	8.4
Soft maple	18	21	39	7.8
White ash	3	2	5	1.0
Total	249	249	498	100.0

TABLE 2—*Number of logs by lengths*

Length in feet	Operation		Total	Percentage of total
	Hand	Air		
8	2	3	5	1.0
10	35	38	73	14.7
12	97	102	199	40.0
14	70	67	137	27.5
16	45	39	84	16.8
Total	249	249	498	100.0

flected in the saw and gig-back time only and therefore would not affect the comparison between the two types of dogs. Distribution of logs by species and length is shown in tables 1 and 2.

To compute the results, the element times for each log position were obtained by subtracting the time at the first timing point from the time at the last timing point bounding that element. Element times for each log position were then added horizontally, as illustrated in Fig. 3, to arrive at the total time consumed for the log for each element of the operation. Total sawing time for each log was then found by subtracting the starting time for that log from the starting time for the succeeding log. The base sawing time, which includes the saw and gig-back time exclusive of turn, undog, dog, set and

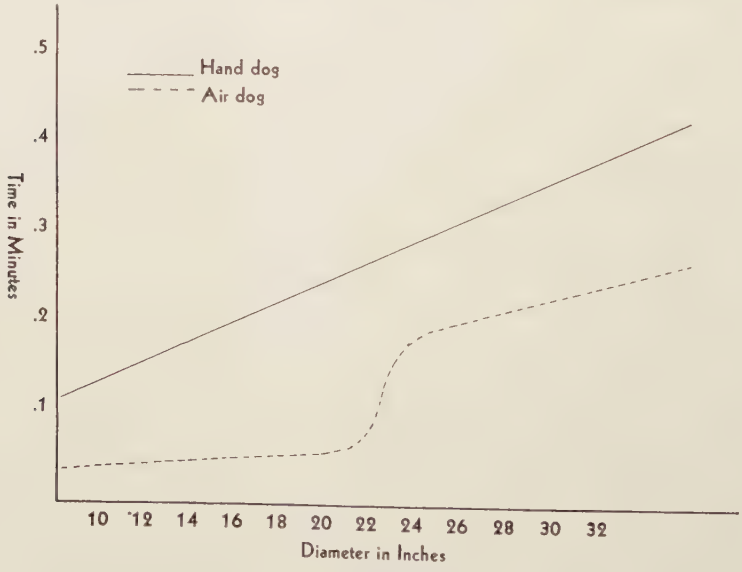

Fig. 4. Undogging time.

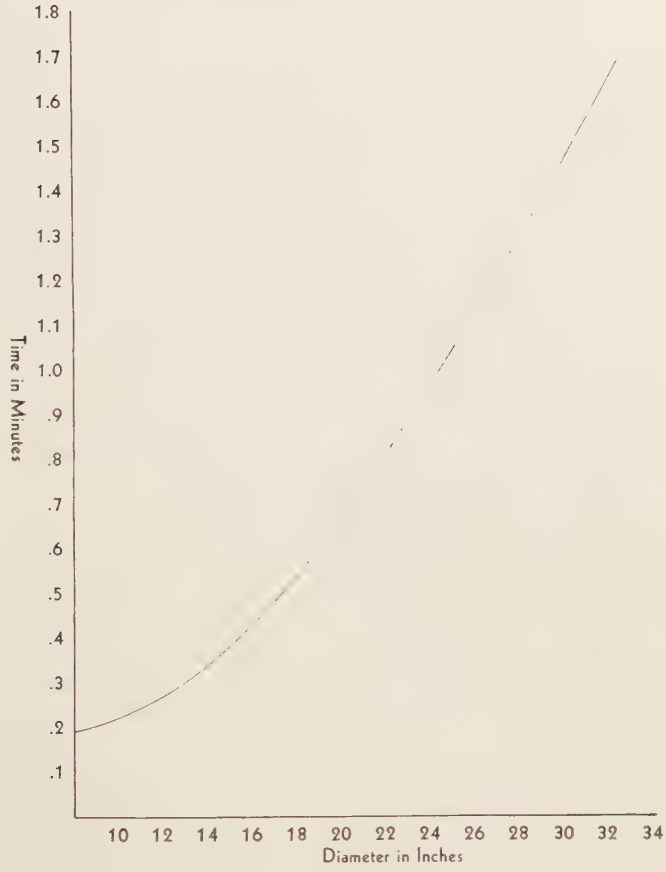

Fig. 5. Turning time.

feed to cut, is the difference between the total sawing time and the sum of the element times for each log.

Cards were then sorted by diameters and the average time computed for each element in each diameter. These are shown in Table 3. The average times were then plotted on coordinate paper, Figs. 4, 5, 6, 7, 8, 9 and 10, and the corrected element times and corrected base sawing times taken from the resulting curves. The air dogs open only to 23 inches so large logs must be held for initial cuts by hand dogs. This accounts for the jump in air dog time curves in Figs. 4 and 6. Table 4 shows the corrected element times and the total of all elements for both the hand and air dog operations for each diameter. In Table 5 the total element time and the base sawing time are added, giving the total sawing time per log for both the hand and air dog operations for each diameter. Multiplying by the number

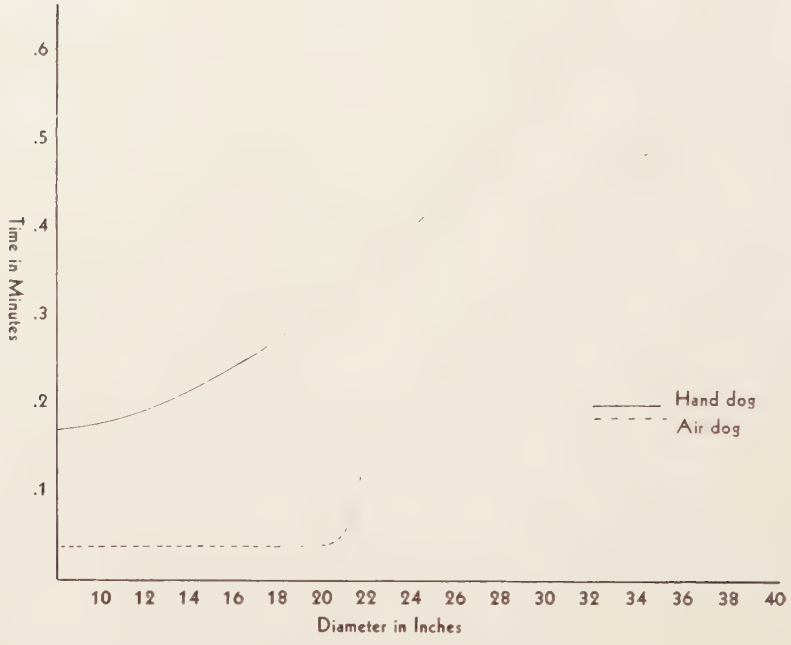

Fig. 6. Dogging time.

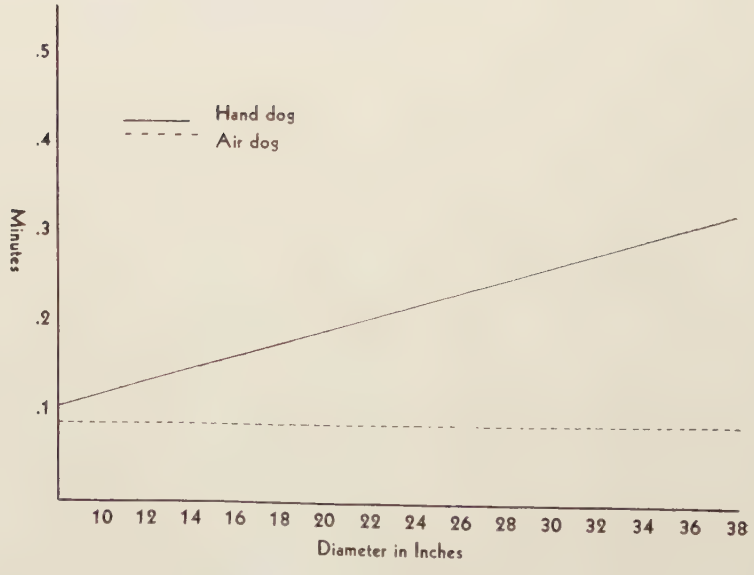

Fig. 7. Time to reach position to set.

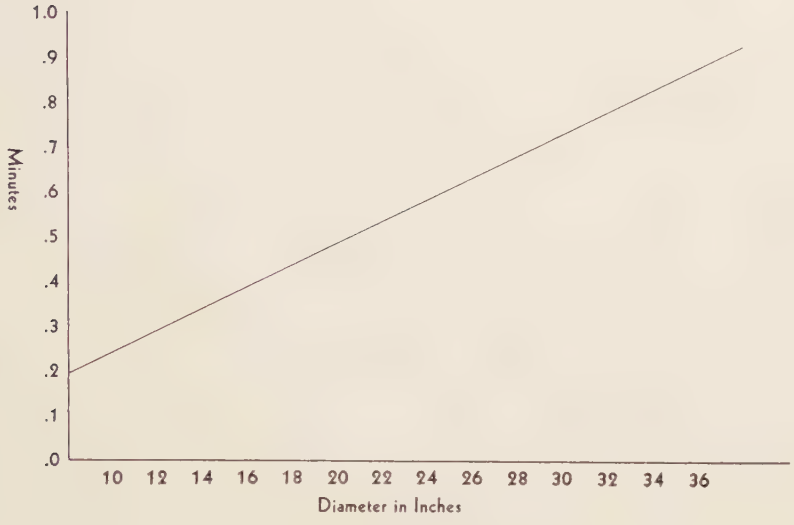

Fig. 8. Setting time.

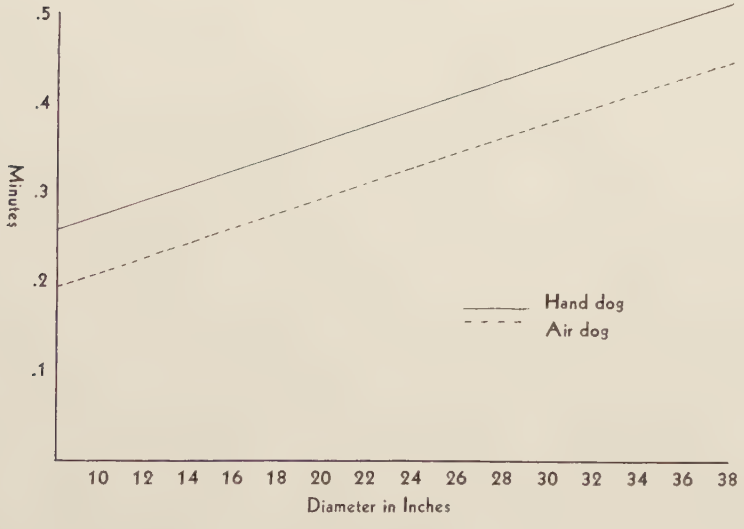

Fig. 9. Feed to cut time.

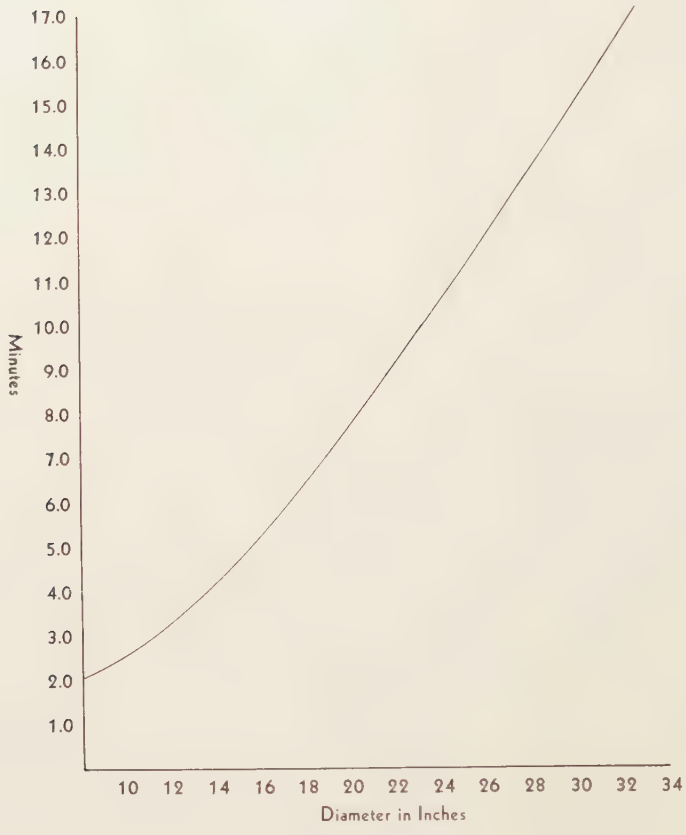

Fig. 10. Sawing time.

of logs in the diameter class gives the total sawing time which would be consumed by that diameter class in the 498-log sample for the hand dog and air dog operations. The difference between the total times is then the time saved by the air dogs for logs in that diameter.

From Table 5 it may be seen that the total sawing time for the 498 logs using hand dogs would be 3,651 minutes and the time saved would be 236.092 minutes if air dogs had been used. The percentage of saving of the the actual sawing time would then be expressed by the following formula:

$$= \frac{\text{Hand dog time} - \text{air dog time}}{\text{hand dog time}} \times 100 = \text{percentage of saving}$$

$$\frac{236.092}{3{,}651} = 6.46\%$$

TABLE 3—*Average element times in minutes by diameters*

Diameter	Number of logs		Undogging		Turning		Dogging		Position to set		Setting		Feed to cut		Sawing and gig-back all logs
	A	H	A	H	A	H	A	H	A	H	A	H	A	H	
9	7	7	.039	.125	.200	.210	.039	.175	.075	.120	.210	.215	.200	.275	2.31
10	8	12	.040	.139	.230	.230	.040	.190	.090	.115	.249	.240	.215	.275	2.58
11	12	12	.040	.132	.265	.250	.038	.170	.080	.130	.250	.285	.215	.290	2.91
12	20	16	.043	.172	.276	.260	.041	.200	.072	.130	.280	.294	.230	.290	3.28
13	23	21	.044	.170	.300	.355	.041	.220	.092	.135	.320	.330	.245	.300	3.75
14	25	25	.048	.170	.340	.338	.039	.205	.085	.160	.360	.302	.225	.308	4.21
15	27	27	.047	.189	.400	.390	.038	.228	.085	.142	.355	.365	.258	.320	4.76
16	29	27	.050	.200	.490	.400	.040	.240	.094	.171	.400	.380	.260	.327	5.03
17	24	25	.052	.220	.500	.480	.043	.256	.078	.163	.380	.412	.270	.340	5.96
18	18	20	.054	.240	.490	.600	.040	.287	.100	.80	.451	.440	.280	.330	6.45
19	12	12	.059	.230	.580	.640	.041	.285	.074	.185	.460	.510	.288	.351	7.01
20	11	10	.059	.243	.722	.700	.042	.305	.105	.190	.500	.486	.284	.350	7.62
21	9	7	.063	.244	.780	.735	.062	.340	.082	.210	.534	.512	.310	.367	8.36
22	7	8	.089	.268	.830	.840	.151	.355	.080	.196	.534	.530	.275	.382	8.93
23	5	6	.160	.285	.862	.950	.200	.410	.090	.205	.571	.580	.308	.380	9.77
24	4	3	.187	.250	.960	.980	.230	.395	.102	.225	.640	.580	.345	.380	10.40
25	5	4	.196	.290	1.130	.990	.247	.426	.080	.225	.610	.654	.330	.413	11.10
26	2	2	.205	.350	1.350	1.220	.280	.420	.095	.230	.630	.740	.355	.400	11.80
27	1	2	.210	.275	1.300	1.180	.300	.500	.080	.245	.670	.660	.340	.410	12.72
28	—	1	—	.300	—	1.280	—	.500	—	.240	—	.690	—	.450	13.27
29	1	1	.230	.370	1.360	1.400	.320	.560	.090	.230	.690	.770	.370	.410	14.00
30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31	—	1	—	.370	—	1.520	—	.550	—	.270	—	.820	.410	.470	15.40
32	1	1	.240	.400	1.840	1.550	.430	.620	.090	.280	.780	.740	.390	.450	16.92

TABLE 4—*Corrected element times in minutes taken from Figs. 4, 5, 6, 7, 8, 9*

Diameter	Undogging		Turning	Dogging		Position to set		Setting	Feed to cut		Total		Saving per log	Percent saved
	H	A		H	A	H	A		H	A	H	A		
9	.123	.038	.205	.172	.038	.111	.086	.218	.265	.200	1.094	.785	.309	28.2
10	.134	.040	.224	.177	.038	.118	.086	.242	.274	.209	1.169	.839	.330	28.2
11	.145	.042	.246	.183	.038	.125	.086	.267	.283	.217	1.249	.896	.353	28.3
12	.157	.044	.273	.191	.038	.132	.086	.290	.291	.225	1.334	.956	.374	28.3
13	.168	.046	.306	.201	.038	.140	.086	.316	.300	.235	1.431	1.027	.404	28.2
14	.178	.047	.345	.213	.035	.147	.086	.340	.308	.243	1.531	1.099	.432	28.2
15	.189	.049	.390	.226	.038	.154	.086	.364	.317	.252	1.640	1.179	.461	28.1
16	.200	.050	.440	.240	.038	.161	.086	.389	.325	.260	1.755	1.263	.492	28.0
17	.212	.052	.492	.255	.038	.168	.086	.414	.333	.269	1.874	1.350	.524	28.0
18	.223	.053	.552	.272	.038	.176	.086	.439	.342	.277	2.004	1.445	.559	27.9
19	.234	.055	.614	.289	.038	.183	.086	.464	.350	.286	2.134	1.543	.591	27.7
20	.245	.058	.680	.309	.040	.190	.086	.489	.358	.295	2.271	1.648	.623	27.4
21	.257	.064	.750	.330	.060	.197	.086	.515	.368	.303	2.417	1.779	.639	26.4
22	.268	.090	.824	.352	.153	.204	.086	.540	.337	.312	2.565	2.005	.560	21.8
23	.279	.158	.900	.375	.197	.212	.086	.565	.385	.321	2.716	2.227	.489	18.0
24	.290	.85	.981	.398	.226	.219	.086	.590	.394	.329	2.872	2.397	.475	16.5
25	.302	.195	1.070	.423	.252	.226	.086	.615	.402	.338	3.038	2.556	.482	15.9
26	.313	.202	1.143	.449	.276	.233	.086	.640	.410	.346	3.188	2.693	.495	15.5
27	.324	.209	1.228	.475	.300	.240	.086	.665	.419	.355	3.351	2.843	.508	15.2
28	.336	.216	1.315	.504	.325	.247	.086	.690	.427	.363	3.519	2.995	.524	14.9
29	.347	.222	1.403	.532	.350	.254	.086	.713	.437	.372	3.686	3.146	.540	14.7
30	.358	.228	1.495	.561	.374	.262	.086	.738	.445	.380	3.859	3.301	.558	14.5
31	.369	.234	1.584	.590	.397	.269	.086	.761	.453	.388	3.026	3.450	.576	14.3
32	.380	.242	1.680	.622	.422	.276	.086	.783	.462	.397	4.203	3.610	.593	14.1

TABLE 5—*Total sawing time in minutes for hand and air dog operations*

Diameter	No. of logs	Base sawing time, Fig. 10	Total from table 4		Total sawing time per log		Total sawing time for sample by log diameter		Time saved Cols. 8–9
			Hand	Air	Hand c. 3–4	Air c. 3–5	Hand c. 2x6	Air c. 2x7	
1	2	3	4	5	6	7	8	9	10
9.....	14	2.30	1.094	.785	3.394	3.085	47.516	43.190	4.326
10.....	20	2.59	1.169	.839	3.759	3.429	75.180	68.580	6.600
11.....	24	2.91	1.249	.896	4.159	3.086	99.816	91.344	8.472
12.....	36	3.31	1.334	.956	4.644	4.266	167.184	153.576	13.608
13.....	44	3.73	1.431	1.027	5.161	4.757	227.084	209.308	17.776
14.....	48	4.20	1.531	1.099	5.731	5.299	275.088	254.352	20.736
15.....	54	4.70	1.640	1.179	6.340	5.879	342.360	317.466	24.894
16.....	56	5.24	1.755	1.263	6.995	6.503	391.720	364.168	27.552
17.....	49	5.80	1.874	1.350	7.674	7.150	376.026	350.350	25.676
18.....	38	6.39	2.004	1.445	8.394	7.835	318.972	297.730	21.242
19.....	24	7.00	2.134	1.543	9.134	8.543	219.216	205.032	14.184
20.....	21	7.66	2.271	1.648	9.931	9.308	208.551	195.468	13.083
21.....	16	8.33	2.417	1.778	10.747	10.108	171.952	161.728	10.224
22.....	15	9.01	2.565	2.005	11.575	11.015	173.625	165.225	8.400
23.....	11	9.71	2.716	2.227	12.426	11.937	136.686	131.307	5.379
24.....	7	10.40	2.872	2.397	13.272	12.797	92.904	89.579	3.325
25.....	9	11.10	3.038	2.556	14.138	13.656	127.242	122.904	4.338
26.....	4	11.81	3.188	2.693	14.998	14.503	59.992	58.012	1.980
27.....	3	12.56	3.351	2.843	15.911	15.403	47.733	46.209	1.524
28.....	1	13.33	3.519	2.995	16.849	16.325	16.849	16.325	.524
29.....	2	14.06	3.686	3.146	17.746	17.206	35.492	34.412	1.080
30.....	—	14.78	3.859	3.301	18.639	18.081	—	—	—
31.....	1	15.57	4.026	3.450	19.596	19.020	19.596	19.020	.576
32.....	1	16.35	4.203	3.610	20.553	19.960	20.553	19.960	.593
	498						3,651.337	3,415.245	236.092

SAVINGS EFFECTED BY AIR DOGS

The L. L. Johnson Lumber Company normally operates 8 hours or 480 minutes a day. Of this, an average of 37.5 minutes are consumed by saw changing, repairs and other non-productive activities, leaving a total of 442.5 minutes a day toward which the saving would apply. The saving in sawing time would then be 442½ minutes × .0646 or 28½ minutes per day.

The mill averages approximately 8,000 feet per operating day. The operators value the time of the sawing minute at not less than 50 cents, although there is good reason to believe it is actually higher than this. When the 50-cent value is applied against the time saved, it may be seen that the saving per operating day is approximately $14.25.

Following is a breakdown of costs of the two-dog assembly.

1.	Air compressor, 9 cubic feet	$227.00
2.	Pressure tank with gage, 10-gallon	20.58
3.	Speed-control valve	5.62
4.	Reducing valve, lubricator, and air cleaner, (Logan assembly)	38.50
5.	2 air cylinders, 3-inch bore, 19-inch stroke, at $40.50	81.00
6.	2 air cylinders, 4-inch bore, 8-inch stroke, at $38.50	77.00
7.	2 valves, Logan, three-way, at $12.00 each	24.00
8.	Air hose, pipe, and fittings	25.00
9.	Steel	22.50
10.	Labor	150.00
	Total	$671.21

The air compressor used to provide air pressure is belted directly to a line shaft which drives the main saw mill; no extra motor need be provided to drive it. Power cost, therefore, is a negligible factor for this particular operation. The only operating costs which need be considered are the cost of alcohol to prevent the lines from freezing, the cost of lubricating oil which is injected into the air lines, and the depreciation of the equipment. Assuming that the equipment will be fully depreciated in 5 years, the total operating expense would be approximately 75 cents per day. The increase in net income would then be: $14.25 — .75 or $13.50 per day.

APPLICATION TO OTHER MILLS

It is impossible to predict accurately the savings which might be effected in other mills by installation of the air dogs without time studies to determine present operating times. However, the results at the L. L. Johnson sawmill may be used to estimate savings.

For purposes of comparing time savings, small sawmills will fall into one of the four following classifications:

1. Mills in which there is one carriage rider, the block setter, who does all the dogging and setting.

2. Mills with a block setter, who also operates the front dog, and a tail dogger to operate the rear dogs.

3. Mills with block setter and tail dogger in which logs are turned by an overhead turner and the tail dogger must step off the carriage to set the turning chain.

4. Mills with no carriage rider in which the sawyer sets the dogs.

The Johnson sawmill is in the first group. Before the air dogs were installed, there was only one carriage rider and normally he set only one dog in a log. Other mills operating in this manner could expect time savings approximately equal to those at the Johnson mill, provided the average daily cut was approximately the same. If the block setter customarily uses more than one dog the saving would be even greater.

In mills of the second group, the block setter usually does the same work as the block setter in the first group. He sets blocks and operates the front dog. He is assisted on the carriage by the tail dogger who operates the tail dogs. If the air dogs were installed, the block setter would be able to set all dogs with less lost time than he now uses to set one dog. Savings in time would be approximately equal to those in group one, and there would be the further saving of the elimination of one man, the tail dogger.

Mills of the third group would save approximately the same amount as the first. The tail dogger can be eliminated from the carriage but he must still be kept to handle the turning chain. There is a possibility with some setups that the work with the turning chain and the log deck work can be combined for further saving.

Mills in the fourth group would be able to save only in time. The dogging operation could be done just as quickly with air dogs as in any of the other mill groups, for the sawyer would be able to control the dogs with two small levers placed within easy reaching distance. The percentage of time saved by an installation of the air dogs would be greater in this than in any other type of mill. However, since these mills are usually small and do not produce as much as larger ones, the value saving would possibly not be as great as in the other three groups.

IMPROVED WORKING CONDITIONS

Owners of the Johnson sawmill feel that the improvement in working conditions is no less valuable than the time saved. With the air dogs in operation, the block setter need climb over the carriage very

little and he never need move on the carriage when he is near the saw. Except when he must set for taper or hold a log against the knees for dogging he can do all his work from one position.

A study of time taken at different periods of the day indicates that no time saving is effected through reduction of fatigue to the block setter. However, the reduction of fatigue is of value to the mill owners because most accidents happen to tired men.

The air dogs also tend to increase the working life of the block setter. Climbing over the carriage is hard for older men, and if they can do their work from one position on the carriage they will not tire so quickly.

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WOOD PRODUCTION ON THE DUNBAR FOREST EXPERIMENT STATION

*By P. W. ROBBINS**
SECTION OF FORESTRY

THE DUNBAR Forest Experiment Station lands are located on the north end of Neebish Island and on the west bank of the St. Mary's River opposite Neebish Island, at the junction of the Charlotte and St. Mary's rivers, 16 miles southeast of Sault Ste. Marie, Michigan.

The first record of a timber sale was made while the property was still in private ownership. Cuttings were made during the winter of 1903 and 1904 for cordwood, and were sold to a dredging company operating on the St. Mary's River. Logging operations in the Dunbar Station area between 1890 and 1925 removed the scattering of white pine and hemlock and the best stands of pulpwood.

While the land was owned by the Dunbar County Agricultural School from 1911 to 1925, only wood was used for fuel. Many hundreds of cords of fuelwood were removed during this period. Since 1925, when the property was taken over by the Forestry Department of the College, all cutting operations have been recorded. This report covers only the original Dunbar Station lands, and does not cover the lands acquired since 1939.

A summary of the cutting operations on the forested area for the period 1926 through 1946 follows:

Cedar fence posts	241
Christmas trees	3,704
Cords of stove wood (16-inch)	977
Standard cords fuelwood	455
Standard cords pulpwood	716
Cubic feet, cabin logs and piling	29,475
Board feet of veneer and saw logs	179,202

*Director, Dunbar Forest Experiment Station 1927 to 1936.

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This represents a cut of approximately 30 percent of the original volume of the forest. Yet the forest is in better condition and growing more rapidly today than it was in 1926.

To illustrate in three areas: The first selection cutting operation in 1926 from one compartment removed 35 standard cords of fuelwood and 11 cords of pulpwood. The fuelwood was consumed at the Station and the pulpwood banked and sold at the mouth of the Charlotte River to the pulp barge operating on the St. Mary's River. In 1927, 55 cords of hardwood were removed in an improvement cutting from another compartment. In 1928, 9 cords of hardwood were removed in an improvement cut in still another compartment, and in 1929, 48 cords of balsam fir and white pine pulp, 8 cords of spruce pulp, 48 cords of hardwood fuel and 700 board feet of hardwood logs were removed during the next improvement cut in the same compartment.

In 1932 and 1933 there were many unemployed persons in Sault Ste. Marie, and to help them and to benefit the forest by an improvement cutting, each person was allowed to cut 4 standard cords of hardwood from trees marked in a 29-acre compartment. Chippewa County transported the men and hauled their wood. In 1930, cutting operations were confined to two experimental plots, one in a spruce-fir-white pine area and one in a red maple-yellow birch-balsam fir area.

When the Station was first acquired, there was no outlet for the sale of saw logs as truck transportation of logs had not been developed in the area. There was a ready market for pulpwood banked on the Charlotte or St. Mary's rivers. Therefore, the cutting plans called for development of the conifer stands and conversion of the low-quality hardwood areas to conifer production.

In 1934 and 1935, with the aid of the Civilian Conservation Corps, much of the aspen and balsam poplar were girdled, where they were suppressing conifers. This girdling project aided the conifers and resulted in a marked increase in their growth.

An area purchased in 1929, from which a local jobber had removed all the merchantable pulp and excelsior wood in 1924, had a good stocking from seedlings established before and after the cutting occurred.

In 1927 a study (1) of the reproduction on the area led to the conclusions that the spruce and balsam fir would fully restock the

area. In 1934 the Civilian Conservation Corps made a thinning and release cutting on this area and removed 33,000 spruce and balsam fir, which left the area with approximately 1,200 conifers an acre spaced 3 to 4 feet apart. The aspen on the area were cut, lopped, and scattered wherever they were suppressing conifers. At the rate this plot is growing, the area will be ready for a second harvest cutting in 30 years or less after the clear cutting of 1924.

Another area purchased in 1932 had been clear cut during the first World War and also had all the merchantable pulpwood removed. Dunbar Station conducted an improvement cutting in this area in 1935 which resulted in rapid growth and development of the spruce and balsam fir. Today, this area is being cut and is producing a heavy volume of pulpwood per acre just 28 years after the first clear cutting.

In 1929 an experimental cutting plot was established on an area which had a total merchantable volume of 22.5 standard cords an acre composed of balsam fir, 41 percent; white spruce, 29 percent; white pine, 6 percent; aspen, 13 percent; and all other species, 11 percent. The cutting removed 59.5 percent of the total merchantable volume. This included all balsam fir down to merchantable size, the spruce down to 10 inches (D.B.H.), and all aspen, birch and maple. On the basis of the growth records so far recorded on this plot, the area will have regained its original volume by the end of 20 years (3).

On the basis of the cutting operations over the entire Dunbar Forest Experiment Station which have removed approximately 30 percent of the original volume, and which have left the forest in better condition and growing more rapidly today than in 1926, and the detailed records from the experimental cutting plots, and the old clear-cut areas, plus Bowman's (1) conclusions that the recovery of cut-over spruce-fir pulpwood lands depends on the nucleus of spruce and fir left after logging, it may be concluded that:

1. The selection method of cutting is adaptable to the spruce-balsam fir type provided a sufficient volume of growing stock of desirable pulpwood species are left.

2. Selection cutting offers protection from windthrow if the degree of cutting is not over 50 to 60 percent and especially if the white pine in the stand is retained for sawlogs in the second cut.

3. Clear-cut areas of pulpwood types will produce a second crop in approximately 28 to 30 years, when they have adequate reproduction on the ground or establish it immediately following logging operations and receive improvement cuttings during the rotation.

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TOTAL AND DIFFERENTIAL LEUCOCYTE VALUES OF BLOOD FROM ALBINO RATS OF THE WISTAR STRAIN

By ANNANELL C. JUBB, RUTH M. NITCHALS, DENA C. CEDERQUIST *and* MARGARET A. OHLSON

SECTION OF FOODS AND NUTRITION

CONCENTRATIONS of the formed elements of the blood are criteria often used in judging the effect of diets. The establishment of average values for each species is necessary for the interpretation of experimental findings. That significant differences in total and differential leucocyte counts of the strains within a species exist has been pointed out by Reich and Dunning (4) in their comprehensive study of the bloods of laboratory rats. They did not study the Wistar strain, and it is hoped that the information in this paper will supplement the meager data in the literature (Griffith and Farris, 1).

The rats used in these studies were of the Wistar strain, and from the same stock. The stock animals were housed six to a cage; the other animals were placed in individual cages. Tap water and diets were fed *ad libitum*. The composition of the diets has been given in previous papers (2, 3).

Animals from the stock colony were selected through 3 to 14 months of age. Rats on the other diets were 3 months of age when blood sampling was begun, and were sampled each month until they were 8 months of age. Eighteen stock rats were sampled, and with the exception of those fed synthetic diet I, there were five males and five females in each of the other groups. The group consuming synthetic diet I was composed of six rats of each sex.

Blood from a tail clip was collected in a paraffin cup containing heparin. All sampling was done in duplicate by the same two persons at the same time of day. Certified Thoma pipettes were used, and the blood was diluted with Osgood's solution. The pipettes were shaken for 3 minutes and the counts made in certified Newbauer im-

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proved hemacytometers. Chambers were checked for uneven distribution and were discarded if irregularities were evident. The average value of four chambers was used in calculating the cell count.

Duplicate smears for differential counts were made on standard alcohol and acid cleaned slides, dried quickly, and stained with Wright's stain. Three hundred consecutive cells were counted.

Mean values for the total and differential leucocyte counts for rats on each of the diets are presented in Table 1. Within any of the dietary groups, the total and differential leucocyte counts differed greatly for any given count regardless of sex or age. The differences in the mean values between the dietary groups are slight, and all are well within the "normal" ranges proposed by Griffith and Farris (1).

TABLE 1—*Mean leucocyte values for adult albino rats from the same stock fed different diets*

Dietary group	Thousand per cmm.	Lymphocytes	Monocytes	Polymorphonuclear cells	Eosinophils	Basophils
		percent	percent	percent	percent	percent
MALE						
Stock						
Mean	8.6	66.9	7.9	23.7	3.6	0.20
Range		57.3 — 86.5	3.0 — 9.3	5.2 — 30.3	1.3 — 6.3	0.0 — 0.65
Synthetic I						
Mean	9.1	77.6	3.3	17.1	1.6	0.15
Range		54.6 — 89.6	1.3 — 11.0	8.6 — 40.3	0.0 — 6.3	0.0 — 1.3
Synthetic II						
Mean	9.1	67.7	5.3	24.7	1.9	0.17
Range		55.3 — 86.5	1.0 — 10.6	9.5 — 36.1	0.0 — 4.6	0.0 — 1.0
Synthetic I +Garlic						
Mean	8.0	79.9	3.0	15.5	1.1	0.12
Range		59.3 — 89.3	0.6 — 6.3	5.6 — 33.3	0.0 — 5.0	0.0 — 0.6
Barley						
Mean	8.7	68.3	4.4	24.8	2.1	0.06
Range		49.0 — 85.0	2.0 — 8.0	12.0 — 42.2	0.6 — 4.0	0.0 — 0.5
Corn						
Mean	8.2	68.3	4.1	25.8	1.0	0.10
Range		49.3 — 84.0	2.0 — 6.6	14.0 — 44.6	0.0 — 2.3	0.0 — 0.3
FEMALE						
Stock						
Mean	8.3	63.7	7.4	25.7	2.6	0.09
Range		43.3 — 77.4	4.0 — 13.0	14.0 — 43.3	0.3 — 4.3	0.0 — 0.6
Synthetic I						
Mean	8.4	75.9	3.3	16.5	1.7	0.18
Range		53.5 — 96.0	0.6 — 9.0	1.0 — 41.6	0.0 — 5.0	0.0 — 1.0
Synthetic II						
Mean	8.7	70.9	3.8	23.2	2.1	0.02
Range		49.0 — 87.0	0.0 — 6.0	8.8 — 41.0	0.6 — 7.3	0.0 — 0.3
Synthetic I +Garlic						
Mean	8.7	76.1	3.3	19.3	1.1	0.09
Range		58.0 — 90.3	0.6 — 7.3	6.6 — 35.6	0.3 — 2.3	0.0 — 0.6
Barley						
Mean	9.2	72.9	3.8	20.9	2.2	0.09
Range		56.0 — 87.8	1.5 — 8.6	3.6 — 37.6	0.3 — 6.3	0.0 — 1.0
Corn						
Mean	8.5	69.0	4.0	25.3	1.5	.00
Range		55.3 — 86.0	0.3 — 8.6	11.0 — 38.6	0.0 — 3.0	0.

TABLE 2—*Comparison of mean leucocyte values for albino rats of different strains with animals from this study*

Authors	No. of rats	Total		Differential							
		Thousand per cmm.		Lymphocytes		Monocytes		Polymorpho-nuclears		Eosinophils	
				Percent		Percent		Percent		Percent	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Griffith and Farris (1)	50	9.0		78.0		1.0		20.0		2.0	
Reich and Dunning (4)	2656	15.4 — 16.2		63.0 — 65.0		6.0 — 6.0		29.0 — 27.0		2.0 — 2.4	
This work	72	8.6 — 8.6		71.5 — 71.4		4.6 — 4.3		21.9 — 21.8		1.8 — 1.8	

Although Reich and Dunning (4) found a much higher mean total count in their studies of other strains, (15.8 thousand per cubic mm. of blood), their values for the differential count are similar to those of Griffith and Farris (1). Table 2 presents the data of these authors for comparison with the average values found in this study.

Averages for all the females by months indicate that the total counts increased sharply during the sixth and seventh months when they were bearing or rearing young. Average values for the male rats increased gradually, but were higher at 3 months than were the average female values (Table 3).

TABLE 3—*Mean total leucocyte values for albino rats by months*

Sex of animals	Age in months					
	3	4	5	6	7	8
Males	8.5	8.5	8.6	8.9	9.1	9.2
Females	7.7	8.1	8.6	9.9	8.7	7.7

SUMMARY

Total and differential white blood-cell counts of albino rats of the Wistar strain which had been fed different diets are presented.

In female rats the leucocyte count increases during reproduction, then recedes. In male rats there is a gradual increase with no recession up to the age of 9 months.

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AN IMPROVED METHOD FOR THE PREPARATION OF THE ANTIBACTERIAL OIL FROM *Allium sativum* L.

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Sections of Agricultural Chemistry and Horticulture

The pungent and irritating substances contained in the tissues of the members of the botanical genus *Allium* have long been of considerable interest to chemists and biologists. Some principles derived from, or present in, the tissues have been considered to be responsible for antibacterial (1-6) and antimycotic (7, 8) properties.

In 1944 Huddleson *et alii* (9) reported the isolation of a crude garlic extract that had strong antibacterial properties. Concurrently Cavallito and Bailey (10) and Cavallito, Buck and Suter (11) isolated from garlic a substance with the empirical formula $C_6H_{10}S_2O$. This substance also showed marked antibacterial action and, according to their report, differed in this respect from substances previously claimed to be the antibacterial principle of the garlic bulb (1, 2, 4, 12, 13, 14). Recently, Rao, Rao and Venkataraman (15) reported the preparation of an active oil and a yield 2.5 times greater than that obtained by Cavallito *et alii* (10).

The authors have used the methods mentioned (9, 10, 15) for the preparation of the active oil. However, in most cases the formation of troublesome emulsions occurred during the extraction of the aqueous alcoholic solutions with ether or chloroform. By employing these methods an oil insoluble in water was also obtained with a much lower antibacterial activity than that of the water-soluble part of the product. In the preparation of their oil, Rao *et alii* (15) did not state that they made a separation of their product with water. This may account for the fact that their preparation had a lower activity than the oil isolated by Cavallito *et alii* (10) since their product must have contained an appreciable quantity of the water-insoluble oil to be described in this paper.

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The present publication is concerned chiefly with an improvement in the method of preparing the water-soluble garlic oil with antibacterial properties. Since garlic oil is quite stable in water (16) and less stable in organic solvents, attempts have been made to reduce the length of time that the oil is kept in organic solvents during preparation. In the preparation procedure to be described, the use of ethanol has been discontinued to avoid concentration of large volumes of this solvent. The initial extraction consists of macerating the garlic cloves with water in a Waring Blendor to permit enzymatic hydrolysis of the precursor, to release the active oil (16, 17, 18), and to insure a better extraction of the active substance. The use of "Hyflo Super-Cel" made possible the filtration of this macerate through a Büchner funnel. By employing this technique, the offensive odor otherwise imparted to the skin and clothing by squeezing the macerate through a muslin cloth can be almost entirely eliminated. The formation of emulsions, generally encountered in extracting aqueous solutions of garlic with ether, was practically eliminated by digesting the solution with pepsin before extraction. Extraction of the digested solution with ether, separation with water, and re-extraction with ether yielded a light straw-colored oil.

The use of ether which has not been freed of peroxides and freshly redistilled, or the heating of the ether solution, or delaying the removal of the ether from the oil, or permitting the oil to stand at room temperature yields a product of which a portion is insoluble in water.

EXPERIMENTAL

One kilogram of garlic cloves was macerated with 1500 ml. of distilled water in a Waring Blendor. The maceration was carried out with small batches of 200 gm. of cloves and 300 ml. of distilled water. After blending all the lot, 125 gm. of "Hyflo Super-Cel" was stirred into the entire macerate. The suspended material was filtered off on a size J Büchner funnel; Whatman No. 4 grade filter paper with a dry ½-inch "Hyflo Super-Cel" pad was used. When the residue was fairly dry, it was washed with two portions of 200 ml. each of distilled water. The filtrate was adjusted to pH 2 with 5 normal sulfuric acid, and then 20 ml. of a 5-percent pepsin solution was added. The liquid was digested in a water bath at 37°C. for 18 hours. At the end of the digestion period, 50 gm. of "Hyflo Super-Cel" was added and the solution filtered through a Büchner funnel by the

technique described above. The residue was washed with 100 ml. of distilled water and the filtrate then extracted with 350 ml., 175 ml., 150 ml., and 100 ml., respectively, of peroxide-free, freshly redistilled ether in a separatory funnel. Occasionally, a slight emulsion may form. This may be broken by the addition of ether to the solution, filtration of the ether-emulsified portion through a Büchner funnel by suction, and subsequent separation of the ether phase in a separatory funnel.

The first extraction was transferred immediately to a round-bottomed flask containing 250 ml. of distilled water. The ether was removed as rapidly as possible by distillation (using a water aspirator) with nitrogen at 16 mm. pressure and room temperature. The second, third, and fourth extracts were added, respectively, to the same flask and the ether removed as described for the first extract. When the solvent has been removed, the flask is stoppered and shaken vigorously to effect solution of the oil in water.

Poor technique and impure solvents will produce a considerable amount of water-insoluble oil containing 46.69 percent C, 5.33 percent H and 40.8 percent S, and having a $N\frac{20}{D} = 1.597$, Sp. g. $\frac{20}{20} = 1.166$ and a molecular weight 158.3 (which changes over night at 25°C. to a molecular weight of 215.1). The oil is soluble in acetone, ethyl acetate, ether, chloroform, benzene, dioxane, ethanol, and methanol. It is slightly soluble in n-hexane and n-heptane. Upon treatment of the insoluble oil with l-cysteine (11), the latter is oxidized to l-cysteine.

Calculated for $C_6H_{12}O_4N_2S_2$: 29.97 percent C, 4.99 percent H, 26.69 percent S, 11.66 percent N. Found: 30.45 percent C, 5.22 percent H, 26.76 percent S, 11.28 percent N. Reported values:

$[\alpha]\ {}^{30}_{D} = -200°$ to $-203°$; m.p. of N phenylurea derivative 160°C. Observed values:

$[\alpha]\ {}^{25}_{D} = -204°$ in 1.0 N hydrochloric acid where C = 1.0 percent; m.p. of N phenylurea derivative 159°C.

The water-insoluble oil should be removed by filtration before neutralization. However, if instructions are carefully followed, the entire yield will be a water-soluble product having strong antibacterial properties. The organic acids and small quantities of sulfuric acid were neutralized by stirring the solution in a 400-ml. beaker with

small portions of barium carbonate until pH 5 was attained. The insoluble barium salts of the acids were filtered off by suction on a Büchner funnel and the residue washed with water. Care must be exercised at this point not to make the solution too alkaline, as a high pH will inactivate the antibacterial principle (11). The filtrate was extracted with 100 ml. of peroxide-free, freshly redistilled ether and then three times with 50-ml. portions. The first ether extract was transferred immediately to a 500-ml. round-bottomed flask and the solvent removed rapidly under nitrogen at 16 mm. pressure and room temperature. The other extracts were transferred separately to the same flask and the solvent removed as previously described. The oil can be dried more rapidly if it is taken up in peroxide-free, freshly redistilled ether and the supernatant ether liquid decanted from the water particles. The ether was again removed *in vacuo* with a water aspirator, and the oil was then dried at 1 mm. pressure at room temperature for 20 minutes. Very seldom is any solid residue found in the oil. If present it may be removed by filtering through a small Hirsch funnel by suction.

The yield of a light-yellow water-soluble oil varies from 2.2 to 4.0 gm. per 1000 gm. of garlic cloves. Variety of garlic and technique used are the principal factors in determining the yield of oil. The oil is very unstable and must be immediately dissolved in water and stored at low temperature. The oil contained 44.31 percent C, 6.20 percent H, 39.52 percent S, and had a molecular weight of 156.8 (which changed at 25° C. overnight to a molecular weight of 215.1). Calculated for $C_6H_{10}S_2O$: 44.44 percent C, 6.17 percent H and 39.51 percent S; molecular weight, 162. Observed values: $N_D^{20} = 1.566$, Sp. g. $\frac{20}{20} = 1.136$; reported values (10): $N_D^{20} = 1.561$, Sp. g. $\frac{20}{20} = 1.114$. The oil was soluble in water, ethanol, methanol, acetone, ethyl acetate, ether, chloroform, benzene, n-hexane and n-heptane.

The active oil reacted with l-cysteine (11) to give S– (thioallyl) cysteine in 85-percent yields. The derivative was recrystallized from dilute ethanol until a constant melting point (dec.) was attained. The S– (thioallyl) cysteine had the following composition and properties: Calculated for $C_6H_{11}O_2NS_2$: 37.31 percent C, 5.70 percent H, 7.25 percent N. Found: 37.14 percent C, 5.35 percent H, 7.71 per-

cent N; m.p. (dec.) 186° C, $[\alpha]_D^{25}$ = — 135° in 1.0 N hydrochloric acid where C = 1.0 percent. Reported values (11): m.p. (dec.) 185°, $[\alpha]$ = — 150° (approximately). These analyses and properties confirm the findings reported by Cavallito *et alii* (10, 11) with the exception of a variation found in the specific gravity and refractive index of the oil and the specific rotation of S— (thioallyl) cysteine.

The oil had strong antibacterial properties when tested against gram-negative, gram-positive, and acid-fast organisms.

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SUMMARY

1. An improved method has been described for the preparation of a water-soluble garlic oil in good yields from *Allium sativum* L. The oil has strong antibiotic properties and the composition is in agreement with that reported by Cavallito *et alii* (11).

2. The isolation and composition of a water-insoluble garlic oil having only slight antibacterial properties is reported.

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POTATO RING ROT CONTROL THROUGH USE OF SEED DIPS AND THE DISINFESTED STATIONARY CUTTING KNIFE

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THE GREATEST increase of potato ring rot occurs during the seed-cutting operation. Prerequisite to its spread is introduction of the causal bacterium [*Corynebacterium sepedonicum* (Spieck. and Kotth.) Skapt. and Burkh.] into the vascular bundles of the potato—and at no other stage in potato production is the bacterium assured of such positive access to the infection court as when the contaminated cutting knife passes through the vascular ring.

Theoretically the killing of ring rot bacteria that have been introduced with a contaminated knife—killing such as might be afforded by a cut-seed dip—would control the disease. Since the practice of dipping is already familiar to potato growers, and the possibility exists of finding a dip that will work against ring rot as well as against scab and rhizoctonosis, numerous disinfestants were tested as cut-seed treatments for ring rot control.

METHODS AND MATERIALS

Tubers to be inoculated were cut with knives that had previously been passed through potatoes diseased with ring rot. The frequency of knife recontamination varied with the different tests, and rates are indicated in the tables. Seed pieces mentioned in tables 1 to 5 were dipped approximately 15 minutes after cutting of the first seed piece. Since some reports (2, 5) indicate that more satisfactory control can be expected from dropping the seed pieces directly into the treating solution, seed pieces mentioned in tables 6 to 8 were treated immediately after cutting.

[1]Solely responsible for data presented in Tables 1 through 9, and jointly with junior author for data in Table 10.

ARTICLE 31-10

Field layouts consisted of randomized rows each planted to 100 seed pieces and replicated four times. Planting was done by hand, with precautions being observed to prevent contamination of seed after treating. Indication of a dip's efficacy was based either on the amount of ring rot wilting in the field or on the amount of macroscopically visible ring rot in the daughter tubers, the particular test used being indicated in each table.

DATA

Table 1 presents results obtained in testing the effectiveness, among other treatments, of mercuric chloride (1: 1000, 1^1_2-2 hours), and shows that this cut-seed dip very satisfactorily controlled ring-rot spread, reducing it by 20 bushels per acre below the untreated plantings. However, the figure under "total" indicates that the treatment also controlled potatoes, significantly reducing yield.

Table 1 also reports results obtained with a rotary cutting knife (indicated by the letter "S"), and shows that this device gave as effective control of ring rot as did mercuric chloride, and, contrary to results

TABLE 1—*Comparison of effects resulting from treatment consisting of seed dip (T), ultra violet selection (U), and rotary knife (S). (Charles Huff farm, McLean, New York)*

Effects	Tubers in bushels per acre		
	Healthy	Diseased	Total
Main—Increase or decrease due to treatment:			
U	− 6.8	− 2.0	− 8.9
S	20.4**	−19.6**	0.8
T ($HgCl_2$ 1:1000, 1^1_2-2 hrs.)	− 9.7	−20.3**	−30.0**
Interactions—Increase or decrease "together" over "separately:"			
US	− 9.1	2.5	− 6.6
UT	− 2.7	2.0	− 0.7
ST	−28.5**	19.5**	− 9.0
UST	6.0	− 1.9	4.1
Least significant differences	±13.0	± 3.9	±12.7

**Significantly different from untreated plantings at 1 percent level.

Variety: Katahdin, containing 2 percent ring rot.
Date planted: June 25, 1943.
Date final ring-rot reading: October 9, 1943.
Knife recontamination rate: 1 cut through tuber infected with ring rot to 5 through seed.

TABLE 2—*Comparison of effects resulting from treatment consisting of seed dip (T), picker planter (P), and rotary cutting knife (S). (Steward Crounse farm, Sennett, New York)*

Effects	Tubers in bushels per acre		
	Healthy	Diseased	Total
Main—Increase or decrease due to treatment:			
T ($HgCl_2$ 1:500 acidulated, 5 min.)	−59.0**	−9.3**	−68.3**
P	−16.4	1.3	−15.1
S	2.7	−4.3**	− 1.6
Interactions—Increase or decrease "together" over "separately":			
TP	12.6	−0.7	11.9
TS	−14.1	4.0**	−10.1
PS	− 1.6	−0.5	− 2.1
STP	− 6.4	0.3	− 6.1
Least significant difference	±19.5	±2.7	±19.3

**Significantly different from untreated plantings at 5 percent level.

Variety: Katahdin, containing approximately 2 percent ring rot.
Date planted: June 19, 1943.
Date final ring-rot reading: October 20, 1943.
Knife recontamination rate: 1 cut through tuber infected with ring rot to 5 through seed.

with mercuric chloride, produced no significant deleterious effect on total yield.

Table 2 shows against the letter "T" that mercuric chloride 1:500, acidulated with 0.2 percent hydrochloric acid, exposure 5 minutes, was effective in reducing ring rot, but that it also reduced total yield. Incidentally, the value against "S" duplicates findings reported in Table 1, that the rotary knife significantly reduced the amount of ring rot and that it exerted no deleterious effect on total yield.

Table 3 reports results obtained using as seed dips 1) unadjusted Malachite Green 1:3000, 2) alkalized Malachite Green 1:3000, and 3) mercuric chloride 1:500 acidified with 0.2 percent hydrochloric acid. The unbuffered Malachite Green did not give significant differences compared with no treatment. The alkalized Malachite Green produced a significant increase in healthy and total tubers as compared with no treatment, and an insignificant decrease in number of diseased tubers. Mercuric chloride gave highly significant increases in yields of healthy and of total tubers and also a highly significant decrease in the number of ring-rot infected tubers. This is in marked contrast with results obtained in the two foregoing tests, and this diversity

TABLE 3—*Comparison of three seed treatments for the control of potato ring rot. (Messrs. C. and R. Van Duser farm, Auburn, New York)*

	Treatments			
	Mal. Green (10 min.)	Mal. Green Alkali (10 min.)	$HgCl_2$, 1:500 Acidif. (5 min.)	Untreated
	Yield (bushels per acre)			
Healthy	107.0	134.6	160.9	102.0
Diseased	27.3	22.4	0.7	32.2
Total	134.3	157.0	161.6	134.2
Differences between treatments	A-D	B-D	C-D	
Healthy	5.0	32.6**	58.9**	
Diseased	−4.9	−9.8	−31.5**	
Total	0.1	22.8**	27.4**	

Least significant differences	5 percent level*	1 percent level**
Healthy	18.2	26.2
Diseased	12.4	17.8
Total	13.5	19.4

Variety: Katahdin, containing approximately 2 percent ring rot.
Date planted: June 9, 1943.
Date final ring-rot reading: October 6, 1943.
Knife recontamination rate: 1 cut through tuber infected with ring rot to 5 through seed.

TABLE 4—*Comparison of three seed treatments for the control of potato ring rot. (Messrs. Shaw and Uhl farm, Southport, New York)*

	Treatments			
	Formalin (1 hr.)	Semesan Bel (½ min.)	Yel. Oxide Mercury (2 min.)	Untreated
	Yield (bushels per acre)			
Healthy	170.1	183.6	162.8	173.6
Diseased	13.4	2.9	0.8	8.8
Total	183.5	186.5	163.6	182.4
Differences between treatments	A-D	B-D	C-D	
Healthy	−3.5	10.0	−10.8	
Diseased	4.6	−5.9	− 8.0	
Total	1.1	4.1	−18.8	

Least significant differences	5 percent level	1 percent level
Healthy	51.2	73.6
Diseased	8.3	12.0
Total	54.9	78.8

Variety: Not indicated. Maine "Selected" seed containing approximately 2 percent ring rot.
Date planted: June 17, 1943.
Date final ring-rot reading: September 12, 1943.
Knife recontamination rate: 1 cut through tuber infected with ring rot to 5 through seed.

TABLE 5—*Comparison of three seed treatments for the control of potato ring rot. (Messrs. Shaw and Uhl farm, Southport, New York)*

	Treatments			
	Crystal Violet (10 min.)	Crystal Violet Alkali (10 min.)	Formalin + Y. Oxide of Mercury (2 min.)	Untreated
	Yield (bushels per acre)			
Healthy	112.3	75.1	199.7	145.0
Diseased	2.4	3.4	10.3	1.2
Total	114.7	78.5	210.0	146.2
Differences between treatments	A-D	B-D	C-D	
Healthy	−87.4**	−124.6**	−54.7*	
Diseased	− 7.9*	− 6.9*	− 9.1*	
Total	−95.3**	−131.5**	−63.8**	

Least significant differences	5 percent level*	1 percent level**
Healthy	40.0	57.4
Diseased	6.5	9.3
Total	38.1	54.8

Variety: Not indicated. Maine "Selected" seed containing approximately 2 percent ring rot.
Date planted: June 17, 1943.
Date final ring-rot reading: September 12, 1943.
Knife recontamination rate: 1 cut through tuber infected with ring rot to 5 through seed.

parallels the conflicting reports in the literature regarding the use of mercuric chloride as a cut-seed dip, indicating that details of the treatment need investigating before it can be recommended.

Table 4 shows the results obtained with formalin, 1 pint in 30 gallons of water, with Semesan Bel at manufacturer's recommended dilution, and with yellow oxide of mercury, 1 pound in 20 gallons of water. None of these treatments produced either significant beneficial or significant injurious results when compared with no treatment.

Table 5 shows results obtained with Crystal Violet 1:3000, the same solution alkalized, and a mixture of yellow oxide of mercury, 0.5 percent, and formalin, 1.7 percent, in water. All three treatments reduced significantly the amount of ring rot, but also exerted a significant deleterious effect on the yield of total tubers.

Table 6 shows the control obtained with various concentrations and times of dipping in two of the newer quaternary disinfectants—di-isobutyl cresoxy ethoxy ethyl dimethyl benzyl ammonium chloride (Hyamine 10X brand) and cetylpyridinium chloride (Ceepryn brand). Also reported here are results with zinc oxide, a material recommended in Australia for the treating of cut seed pieces (1). All treatments

TABLE 6—*Comparison of six seed dips for the control of potato ring rot. (Ronald Clark farm, Gaylord, Michigan)*

Disinfectant	Concentration (active ingredient)	Time (min.)	Hills/four 100-foot replications		
			Healthy	Diseased	Total
1. Hyamine 10X	1:1000	to 5	169	162**	331**
2. Hyamine 10X	1:10000	to 5	210	160**	370
3. Hyamine 10X	1:1000	15–30	227	84**	311**
4. Hyamine 10X	1:10000	15–30	248	129**	377
5. Zinc oxide + wetter	4 pounds in 4 gallons water.	15–30	228	119**	347
6. Sterile check		—	349	10**	359
7. Ceepryn	1:1000	15–30	238	45**	283**
8. Inoculated check		—	152	229	381

*Significantly different from untreated plantings at 5 percent level.
**Significantly different from untreated plantings at 1 percent level.

Variety: Chippewa (Sterile check indicates that ring rot was present in this seed stock).
Date planted: May 25, 1946.
Date final ring-rot reading: September 6, 1946.
Knife recontamination: before each cut.

resulted in significant control, though not to a degree sufficient to suggest that these chemicals be recommended against knife-spread ring rot. The 1:1000 concentrations of the quaternaries also reduced significantly the total yield, and the di-isobutyl at 1:1000 (treatments 1 and 3) was observed to have inhibited corking over.

Table 7 shows control obtained with the following: 1) alkyl dimethyl benzyl ammonium chlorides (Roccal brand), 2) N(acyl colamino

TABLE 7—*Comparison of seven seed dips for the control of potato ring rot. (John Oberthur farm, Talbot, Michigan)*

Disinfectant	Concentration (active ingredient)	Time (min.)	Pounds tubers/four 100-foot replications		
			Healthy	Diseased	Total
1. Roccal	1:1000	to 30	236.5	27.8**	264.3
2. Emulsept	1:1000	to 30	268.7	32.1**	300.8
3. Steri-Chlor	2000 ppm. available Cl_2	to 30	93.6	4.8**	98.4**
4. Tetrosan	1:1000	to 30	249.9	23.2**	273.2
5. Isothan Q-15	1:1000	to 30	238.2	13.1**	251.3
6. Hyamine 1622	1:1000	to 30	236.4	20.2**	256.6
7. Puratized	1:1000	to 30	160.3	7.1**	167.4**
8. Untreated check		—	192.0	73.5	265.5

*Significantly different from untreated plantings at 5 percent level.
**Significantly different from untreated plantings at 1 percent level.

Variety: Russet Rural. No systemic ring rot encountered while cutting 3200 seed pieces, nor was the disease observed in the 100 hills planted to whole, uncontaminated seed.
Date planted: June 3, 1946.
Date final ring-rot reading: October 6, 1946.
Knife recontamination: before each cut into healthy seed.

formyl-methyl pyridinium chloride) (Emulsept brand), 3) sodium para-toluene-sulfonchloramide (Steri-Chlor brand), 4) alkyl dimethyl 3,4-dichlorobenzyl ammonium chloride (Tetrosan brand), 5) lauryl isoquinolinium bromide (Isothan Q-15 brand), 6) di-isobutyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride (Hyamine 1622 brand), and 7) phenyl mercuri triethanol ammonium lactate (Puratized brand). The data show that all disinfectants produced highly significant control of ring rot, though all with the exception of Tetrosan and Emulsept caused reductions in total yield, Steri-Chlor and Puratized significantly so. Corking over was seriously interfered with after dipping in Steri-Chlor at the strength used.

Table 8 reports results obtained with sodium hypochlorite and with alkyl dimethyl benzyl ammonium chlorides at various concentrations and exposures as seed dips. No treatment gave a significant difference nor an adequate control of the disease.

From the findings reported above it may be concluded that there are dips which will reduce materially the spread of ring rot. None of them, however, gives a sufficiently high degree of control to warrant adoption. Adoption is further unwarranted because injury to cut seed results from use of some of these chemicals. It is also quite awkward to have to cut directly into the treating solution. Finally, the advisability of seed dips is questioned because of data recently announced by the Colorado Agricultural Experiment Station (3, 4) showing that a thin trickle of disinfectant (mercuric chloride) running constantly over a stationary cutting knife will give excellent and quite simple control of knife-initiated ring-rot spread. The Colorado method consists of

TABLE 8—*Comparison of two seed dips at various concentrations for the control of potato ring rot. (Otto Winkel farm, Cooks, Michigan)*

Disinfectant	Concentration (active ingredient)	Time (min.)	Pounds tubers/four 100-foot replications		
			Healthy	Diseased	Total
1. Roccal	1:1000	to 5	316.5	27.5	344.0
2. Roccal	1:10000	to 5	297.5	25.0	322.5
3. Roccal	1:1000	15–30	268.0	13.0	281.0
4. Roccal	1:10000	15–30	280.0	28.0	308.0
5. Sodium hypochlorite	400 ppm. available Cl_2	to 5	271.0	30.5	301.5
6. Untreated check		—	285.0	24.5	309.5

Variety: Pontiac. No systemic ring rot encountered while cutting 3200 seed pieces, nor was the disease observed in the 100 hills planted to whole, uncontaminated seed.
Date planted: June 8, 1946.
Date final ring-rot reading: October 1, 1946.
Knife recontamination: before each cut into healthy seed.

Fig. 1. Cutting seed with a "trickle knife" (stationary knife with corrosive sublimate trickling down the blade) to check spread of potato ring rot by cutting knife. (Photographed in cooperation with Farm Quarterly.)

placing a can of disinfectant above the cutting knife, fastening one end of a rubber tubing to a petcock at the bottom of the can, and attaching the other end of the tubing to the top of the stationary cutting knife. The petcock is opened sufficiently to permit a thin trickle of disin-

TABLE 9—*Comparison of seven stationary knife disinfectants for the control of potato ring rot. (Carl Hessler and Son farm, Rockford, Michigan)*

Disinfectant	Concentration (active ingredient)	Hills/four 100-foot replications		
		Healthy	Diseased	Total
1. Mercuric chloride	1:500	239	0	239
2. Tetrosan	1:1000	252	20	272
3. Roccal	1:1000	211	2	213
4. Hyamine 1622	1:1000	215	0	215
5. Onyxide	1:1000	229	3	232
6. Copper sulfate	2 pounds in 10 gallons water	120	0	120
7. Isothan Q-15	1:1000	235	5	240
8. No disinfectant—check		193	45	238

Variety: Chippewa (Michigan certified). No systemic ring rot encountered while cutting 3200 seed pieces, nor was the disease observed in the 100 hills planted to whole, uncontaminated seed.
Date planted: June 20, 1946.
Date final ring-rot reading: September 26, 1946.
Knife recontamination: after each 5 cuts into healthy seed.

fectant to run continuously down the sides of the knife. Figure 1 illustrates the device as used in the following trials.

The "trickle knife" was tested in Michigan under field conditions in 1946, with various chemicals as disinfectants, including 1) mercuric chloride, 2) alkyl dimethyl 3,4-dichlorobenzyl ammonium chloride (Tetrosan brand), 3) alkyl dimethyl benzyl ammonium chlorides (Roccal brand), 4) di-isobutyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride (Hyamine 1622 brand), 5) alkenyl dimethyl ethyl ammonium bromide (Onyxide brand), 6) copper sulfate, and 7) lauryl isoquinolinium bromide (Isothan Q-15 brand). The cutting knife was recontaminated by passage through a ring-rot infected potato before making five cuts into seed pieces ultimately planted. The field layout was of the same size and arrangement as that used in the experiments already reported. Table 9 shows the degree of control obtained with each of these disinfectants. While all of them markedly reduced the amount of ring rot, complete control was obtained only with Hyamine 1622, mercuric chloride, and copper sulfate.

Further testing of the "trickle knife" was carried out in 1947, with confirmatory runs being made of the materials found to be best in the 1946 tests, mercuric chloride 1:500, copper sulfate, 2 pounds in 10 gallons water, and Hyamine 1622, 1:1000. Additional materials tested were Roccal 1:500, Roccal 1:1000, Rohm and Haas Experimental Product L4552 1:500, and Sharples Experimental Product EC2550 1:500. The field layout was the same as that previously described.

TABLE 10—*Comparison of seven stationary knife disinfectants for the control of potato ring rot. (Lloyd Swanson farm, Sands, Michigan)*

Disinfectant	Concentration (active ingredient)	Hills/four 100-foot replications		
		Healthy	Diseased	Total
1. Mercuric chloride	1:500	377***	22***	399
2. Roccal	1:500	177**	220**	397
3. Roccal	1:1000	85	310	395
4. Hyamine 1622	1:1000	139*	257*	396
5. R & H L4552	1:500	108	287	395
6. Sharples EC2550	1:500	99	289	388**
7. Copper sulfate	2 pounds in 10 gallons water	349***	42***	391*
8. No disinfectant—check		69	331	400

Differences between treatments.	1 – 8	2 – 8	3 – 8	4 – 8	5 – 8	6 – 8	7 – 8
Healthy	308	108	16	70	39	30	280
Diseased	309	111	21	74	44	42	289
Total	1	3	5	4	5	12	9

Least significant differences	5 percent level*	1 percent level**	0.1 percent level***
Healthy	65.50	89.12	120.29
Diseased	65.13	88.62	119.62
Total	6.68	9.09	12.27

Variety: Green Mountain. No systemic ring rot encountered while cutting 3200 seed pieces, nor was the disease observed in the 200 hills planted to whole, uncontaminated seed.
Date planted: June 6, 1947.
Date final ring-rot reading: September 3, 1947.
Knife recontamination rate: after each 5 cuts into healthy seed.

Table 10 reaffirms the efficacy of mercuric chloride and copper sulfate as stationary cutting knife disinfectants. Only 5.5 percent of seed pieces cut with a knife treated with mercuric chloride showed ring rot, and 10.7 percent of those cut with a knife treated with copper sulfate showed ring rot. When no disinfectant was used, the percentage of ring rot amounted to 82.8. Both mercuric chloride and copper sulfate proved highly significant in stopping ring rot (beyond the 0.1 percent level) when compared with the untreated plantings. The difference between these two chemicals is not significant, though the trend favors mercuric chloride. Other disinfectants showed lesser degrees of control.

DISCUSSION AND CONCLUSION

The possibility of using seed dips appears at first to hold promise for halting knife spread of ring rot. Growers would be ready to adopt dips because of previous familiarity with this method of treating seed, while they might oppose adoption of the rotary cutting knife. Furthermore, a material might be found combining ring-rot control with that

of scab and rhizoctonosis for which dips are already in common use. With these advantages of dips in mind, numerous chemicals were tested under field conditions, including some of the common potato treatments, various bacteriostatic dyes, and the newer quaternary compounds. As testing proceeded, various inadequacies of dipping came to light. Some materials, at the strengths tested, failed to control ring rot at all; one disinfectant, formalin, 1 pint in 30 gallons, even resulted in more ring rot than that shown by the untreated plantings. Other materials like mercuric chloride, while giving adequate control of ring rot, produced injury to the seed and caused a reduction in yield below that of untreated plantings. Some other chemicals gave a fair degree of control but none to an outstanding degree. In addition, all dips required the cutting of seed directly into the solution—and this proved to be an awkwardness no grower could be asked to tolerate.

Further search for a ring-rot dip became less justifiable on publication by Colorado Agricultural Experiment Station workers (3, 4) of results showing the efficacy of the stationary disinfected cutting knife for controlling ring rot. This device, notable for its simplicity, was tested under Michigan conditions for the past 2 years, and results confirm those of the Colorado Station workers. The best material for continuously disinfecting the knife proved to be mercuric chloride, 1:500. The knife is so simple and cheap to construct that any grower can provide himself with protection from the spread of ring rot. No alteration in customary cutting with stationary knives is required, and for growers who still cut with paring knives, adoption of the stationary knife with "trickle" attachment will actually accelerate the cutting operation.

Details of constructing the "trickle knife" can be inferred from Fig. 1. All that is required is a can or crock with a petcock at bottom, rubber tubing extending from the petcock to the top of the knife blade, and a sleeve of lamp wick inserted between blade and tubing to insure trickling of solution over both surfaces of the knife. The can is filled with mercuric chloride solution (1:500), the petcock opened so that a thin stream runs down each side of the upright knife, and seed cutting is carried out in the customary fashion.

SUMMARY

Hope of finding a cut-seed dip for knife-spread ring rot led to the testing at different concentrations and exposure times of 1) mercuric chloride, 2) mercuric chloride acidified, 3) yellow oxide of mercury,

4) formalin, 5) yellow oxide of mercury plus formalin, 6) Semesan Bel, 7) sodium hypochlorite, 8) sodium paratoluene sulfonchloramide, 9) Malachite Green, 10) Malachite Green alkalized, 11) Crystal Violet, 12) Crystal Violet alkalized, 13) alkyl dimethyl benzyl ammonium chlorides, 14) N(acyl colamino formyl-methyl pyridinium chloride), 15) lauryl isoquinolinium bromide, 16) alkyl dimethyl 3, 4-dichlorobenzyl ammonium chloride, 17) di-isobutyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride, and 18) phenyl mercuri triethanol ammonium lactate. No cut-seed dip tested, however, possessed sufficient advantages to warrant its recommendation.

The disinfested stationary cutting knife was tested under Michigan conditions and with the following knife disinfectants: 1) mercuric chloride, 2) copper sulfate, 3) alkenyl dimethyl ethyl ammonium bromide, 4) alkyl dimethyl 3, 4-dichlorobenzyl ammonium chloride, 5) lauryl isoquinolinium bromide, 6) di-isobutyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride, 7) alkyl dimethyl benzyl ammonium chlorides, 8) Rohm and Haas Experimental Compound L4552, and 9) Sharples Experimental Compound EC2550. Best control was obtained with mercuric chloride, and this material used with the "trickle knife" is recommended for control of knife-spread potato ring rot in Michigan.

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STRAIN DIFFERENCES IN THE MONTMORENCY CHERRY

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MONTMORENCY is one of the oldest of the cultivated varieties of the sour cherry. It was grown in Europe long before the advent of commercial fruit production in this country and was one of the varieties introduced early in America. Some of the many names applied to the variety as it grows in Europe suggest clearly that a number of strains have been developed and found their way into cultivation. In this country it is generally recognized and grown as a single variety under the one name, but it nevertheless exhibits considerable variation in both tree and fruit characters.

In the course of an extensive study of bud variation in tree fruits in Michigan, many Montmorency orchards were visited and tree, flower and fruit differences were noted. In all, 301 individual trees or branches (bud sports) were found that presented some peculiarity of appearance or behavior that seemed to set them apart as more or less distinct strains. These were rechecked another year and in many instances year after year for a considerable period to learn whether the difference noted was permanent or something due to a temporary environmental influence. One hundred and sixty-six of these variant forms that appeared to be more or less permanent were propagated and the trees grown to fruiting age (some were kept in the orchard for 16 years). At the same time, a considerable number of trees were propagated and grown of the parent or normal form of the variety to serve as checks on the variants. In due course of time, suitable records were made of the vegetative, flower, and fruit characteristics and the yields of the daughter trees.

Many of the differences noted in the original variant trees or limbs appeared in the daughter trees; others did not. The records showed clearly, however, that there is not only great tree-to-tree and limb-to-

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limb diversity in the Montmorency cherry, but that many of these variants are of the nature of intra-variety strains. How much of a deviation from type is necessary before it can be classified as a strain is of course a matter of judgment. Some qualified individuals after carefully studying the Experiment Station's collection of Montmorency forms might say that it included upwards of 100 distinct strains; others equally well qualified might put the number at less than 10. There are, for instance, several petal-less forms that are otherwise entirely normal for the variety in tree and fruit characters. Obviously they would not be recognized as distinct strains unless seen at blossoming time. There are forms with distinctly cordate fruits. Probably fewer would be inclined to consider this feature worthy of recognition as a character identifying a distinct strain than they would a comparable difference in fruit size, maturing season or tree productivity. A difference of 10 days or 2 weeks in maturing season would much more probably be recognized as characterizing a distinct strain than would a consistent difference of 5 to 7 days.

In the study of intra-variety variation in the Montmorency cherry at the Michigan Station, no attempt has been made to appraise the variants from the standpoint of which ones may and which may not be entitled to strain rank. The effort has been, rather, to study: 1) the nature of the differences, 2) their permanence or fixity as influenced by seasonal and other environmental conditions and 3) as evidenced by the performance of daughter trees propagated from them, and finally 4) to appraise them from the viewpoint of possible commercial value. In attempting to evaluate them on the basis of their possible use to the producer, they may be arbitrarily grouped according to certain features or characteristics, as follows:

Healthy or virus (yellow leaf)—infected.
Relatively vigorous or relatively weak.
Relatively productive or relatively unproductive.
Fruits relatively large or fruits relatively small.
Fruit normal in maturing season or late in maturing.
Aberrant form (e.g., with long-stemmed fruits).

Healthy and Virus-infected Strains—When the collection of Montmorency cherry strains was begun in the twenties, the yellow leaf virus or yellows disease was not recognized as a disease. It was, nevertheless, present, and a number of the early "strains" that were collected were infected with the disease. Indeed one of them was

described and propagated as a "yellow leaf" strain. The virus-infected strains have, of course, remained infected. Furthermore, individual trees of some of the strains free from the virus at the time they were planted have become infected. Others have remained free, though grown in close proximity to infected stock. Thus there has been the opportunity to compare virus-infected with healthy strains as well as different healthy strains with each other.

In general, infection with the virus has resulted in a distinct dwarfing of the trees and a marked reduction in productivity over and above that which would be associated with the difference in tree size. Thus in 1940, after 6 years in the orchard (8 years after the buds were set in the nursery row), 94 virus-free trees of 23 different Montmorency selections or strains had an average trunk circumference of 7.2 inches; 107 virus-infected trees of 24 selections or strains had an average trunk circumference of 5.5 inches. The average yield per tree per season of 68 virus-free trees of 15 different strains for the 1939-1941 seasons (trees planted in the spring of 1934) was 11.9 pounds; the average yield per tree per season of 68 virus-infected trees of 17 different strains for the same seasons, planted at the same time and grown under strictly comparable conditions, was 6.1 pounds.

There were substantial differences in both growth and yield of different groups (strains) of virus-infected trees. Thus trees of Strain 178 averaged 10.2 pounds yearly during the 1939-41 seasons as 5- to 7-year-olds, while trees of Strain 351 under strictly comparable conditions averaged only 1.9 pounds. Later performances of the same groups of trees have been consistent with their 1939-41 records. This suggests two possibilities: 1) that there are different strains of the virus, some of which are far more virulent than others, or 2) that there are strain differences within the Montmorency variety differing markedly in their degree of resistance or susceptibility to the disease, or perhaps more accurately, to its weakening effects. One instance in the records of the Experiment Station indicates rather clearly that there are strain differences in resistance to the disease, though it does not preclude the possibility of there being different strains of the virus. Bud wood for propagating strains 262 and 263 was obtained at the same time from different parts of the same tree. The parent branch for Strain 262 was distinctly weak and unproductive; the rest of the tree, one of whose branches furnished bud wood for Strain 263, was far from being vigorous and productive, but it was more vigorous and more productive than Branch 262. All of the daughter

trees of Strain 263 were *semi-dwarf*, those of Strain 262 were *dwarf*. Their average yearly yields per tree for the 1939-41 period were 6.6 and 2.5 pounds, respectively. The parent tree and all of its daughter trees were virus-infected; the different branches of the parent tree and likewise their daughters presumably were infected with the same strain of the disease.

Strain 178 has been grown in several different blocks planted at different times and places on the Experiment Station grounds. There is no question about all of them being virus-infected, but this strain has been consistently a fairly good performer in the orchard, better than some of the virus-free but rather weak strains. Its performance and that of several others infected with the virus suggests the practicability of selecting and growing strains that are able to tolerate the disease and still thrive rather than attempting to keep healthy, but virus-susceptible, stocks free from the disease by continuous roguing.

Vigorous and Weak Virus-free Strains — In an earlier publication of the Michigan Station,[1] data were presented showing that there are differences in size and vigor of certain Montmorency cherry trees having no evidence of virus-infection that are transmitted to their vegetative offspring. In other words, there are intra-variety strains with differences in tree size and vigor. These differences in size of tree may be of such a magnitude as 3 to 2 or even 2 to 1. The records of the Michigan Experiment Station show clearly that there are equally great differences in strain performance, as measured by tree yield. For instance, the average annual yield of 5- to 7-year-old trees of Strain 450 during the 1939-41 period was 8.0 pounds, that of Strain 468 was 9.9 pounds; during the same period and under the same conditions the average yields of strains 264 and 516 were 15.2 and 17.6 pounds, respectively. Not every tree bearing a relatively heavy crop in one particular season will each and every year outbear the surrounding trees in an orchard. Heavy production one year may be followed by a lighter crop the next season, as is often true of apples. If, on the other hand, over a considerable period of years the average yields of a group of trees of one vegetative parentage are substantially greater or less than those of another group of another parentage, it is evidence of a genuine strain difference.

[1]Studies in the Nature of the Clonal Variety. III. Permanence of Strain and Other Differences in the Montmorency Cherry—Gardner, V. R.—Mich. Agr. Exp. Sta. Tech. Bul. 186. 1943.

Large-fruited and Small-fruited Strains — Size of fruit borne by different trees in any one season can be readily measured. Determination of differences in fruit size between two or more strains is more difficult. Size of fruit is greatly influenced by the relative size of the crop that is borne, not only by the tree as a whole, but by individual branches, by abundance of foliage, by localized variations in soil depth and condition, by the kind and amount of spray materials used, and by many other factors. After due evaluation of all such factors, however, the records obtained at the Michigan Station over a period of 20 years show clearly that some strains of the Montmorency cherry consistently bear rather large fruits while others bear relatively small ones. For instance, in 1936, the average weights of individual fruits from four trees of Strain 150 ranged from 2.67 to 3.08 grams, with a mean of 2.84; under the same conditions, individual fruits of four trees of Strain 168 ranged from 2.02 to 2.70 grams, with a mean of 2.34. In view of the fact that the crops borne by the two groups of trees were comparable and the difference seemed to be consistent year after year, it is believed that these two selections represent a true strain difference in respect to fruit size. Though not striking, it is great enough to be of commercial importance. A more striking difference in fruit size is presented by the records of selections 481 and 482. Selection 481 was propagated as a "normal" Montmorency, as a check against a small-fruited, early-maturing limb variant. In 1936, the mean weight of 3,528 fruits harvested as a random sample of Selection 481 was 2.378 grams while that of a random sample of 9,856 fruits from its limb sport was 1.584 grams; this was in spite of the fact that the limb sport was less heavily loaded than the parent form. Daughter trees of these two forms in later years consistently produced fruits that showed a similar difference in size.

Strains Differing in Maturing Season — Some strain differences in maturing season are almost as difficult to recognize and evaluate as are strain differences in fruit size, for maturity is delayed by heavy cropping and defoliation due to leaf spot, spray injury, winter injury of the blackheart type, and other factors. On the other hand, many striking instances of early or late maturity, differences of a week or more, are readily recognized. In the course of the bud-sport studies at the Michigan Station, a few early-maturing and many late-maturing strains have been found and propagated. Both early-maturing and late-maturing strains that are practically identical with the nor-

mal parent form in other respects would be welcome additions to the variety and strain list, for they would extend the harvesting season. In the course of the studies at the Michigan Station, practically all of the late-maturing strains have been found to be less productive than the normal form, or to ripen their fruits unevenly, and the few early-maturing strains have not been enough earlier to make them of great value.

Aberrant Forms — Incident to this study, many aberrant forms have been found and some of them have been propagated and carefully studied. These include long-stemmed strains, strains with small-petaled or petal-less flowers, those whose fruits are heart-shaped or with deep sutures, barren or semi-barren strains, etc. Some of these are very interesting forms, but few, if any, promise to be of any commercial value.

Superior Strains

No commercial producer would knowingly set virus-infected trees; nor would he deliberately set trees that he knew would be below average in vigor and productivity, or that were uneven in ripening season. Certainly he would not plant any aberrant forms.

The ideal strain from the standpoint of the producer is, among other things, one that is both virus-free and virus-resistant or that will tolerate infection and still thrive; it should grow vigorously and make a large tree; it should blossom relatively late and its flower buds and flowers should be resistant to frost; its blossoms should "set" well; it should be very productive; its foliage should be resistant to leaf spot and to spray injury; its fruits should be large and mature evenly.

No strain has been found that possesses all these requirements to the desired degree. Several have been found and tested over a period of years and found to be *relatively* good. This does not mean that they are resistant to the yellow leaf virus; whether they are is unknown at the present time, for they have not been evaluated in this respect by inoculation tests. However, the stocks of them in the Station's plantings have thus far remained virus-free. They are vigorous, thrifty growers and relatively heavy producers of fruits medium to above medium in size. Bud wood of these strains certified as virus-free by the inspection service of the Michigan State Department of Agriculture after suitable "indexing" tests, has been made available

to nurseries requesting it, and stock of them is being propagated and sold by the nurseries. It should be pointed out that there is no guarantee that trees of any one of these strains may not become infected with the yellow leaf virus after the buds have been set in the nursery row or after the trees have been planted in the orchard, if there are near-by sources of infection. Brief descriptions of four strains that have thus far been released to the nursery trade follow.

Strain 264 is simply to be regarded as a good strain of Montmorency, normal in its various characters. The parent tree grew in an orchard near Mears in Oceana County, Michigan. Though rather unfavorably located, this tree had a good production record. Daughter trees on the Experiment Station grounds have been large, vigorous, productive, and have been virus-free. Their fruit has been of good size and has ripened evenly. Yields per tree per year during the 1939-41 period, as 5- to 7-year-olds, averaged 15.2 pounds, compared with 11.9 pounds for 15 virus-free strains.

Strain 297 was propagated from a tree in the Traverse City area that was known to have borne heavy corps year after year for many years. Its daughter trees in the Michigan Station's orchard are especially thrifty, vigorous growers. Their average yield per tree per year during the 1939-41 period was 12.4 pounds, again compared with 11.9 pounds for 15 virus-free strains.

Strain 465 was propagated from an exceptionally large vigorous tree in an orchard near South Haven, Michigan. The yields of its daughter trees in the Station's test have been only slightly above the average for other virus-free strains. It is probably not an exceptional, but it is a good, strain.

Strain 516 was propagated from what originally was taken to be a productive limb sport in a tree in the same orchard from which Strain 465 came. Yearly checks on the performance of the parent limb with that of the remainder of the tree indicated that it was an exceptionally heavy producer. This heavy production was due to a slight but consistent difference in susceptibility of the flower buds to killing by low temperature while in a swollen or "delayed dormant" stage in the spring and to rather marked and consistent difference in percentage of blossoms that set and matured fruit. Some of the records obtained on the performance of this limb sport (Selection 516) and the rest of the same tree (Selection 517), which may be regarded as a normal Montmorency, are interesting. On April 25 and 26, 1933,

frosts resulted in considerable killing of unopened buds in this orchard; 68 percent of the individual flower buds were killed on Branch 516, 87 percent on 517. There was no corresponding injury in 1934, but in 1935 there was considerable delayed dormant killing of flower buds. It amounted to 41 percent on Branch 516, 48 percent on 517. On April 22, 1938, the temperature fell to 22° F. at the Graham Station where young trees of both these strains were growing. Seventy-one percent of the flower buds were killed on Strain 516, 79 percent on Strain 517. The differences in bud hardiness were small but consistent from year to year. In 1933, when neither the parent limb sport 516 nor the rest of the tree, 517, bore heavy crops, the percentages of flowers that set and matured fruits were 9 and 1.4, respectively. In 1934, when Branch 516 bore a heavy crop and 517 bore a light one, fruit setting on the two parts as determined from counts of large random samples was 35 and 8 percent, respectively. In 1935 the corresponding percentages were 27 and 6. In 1936 they were 14 and 5. On the other hand, in 1937 when conditions were very favorable for fruit setting, daughter trees of both strains at the Graham Station set exceptionally high percentages, 49 and 62, respectively, Strain 517 exceeding 516. Average annual yields per tree per year of the two strains for the 4-year period 1939-42 were 19.5 and 14.4 pounds, respectively, on trees of essentially the same size. This rather long series of records leaves little doubt that 516 is an excellent strain.

No claim is made that any one of these strains is the best that can be found or even that they are better than others being propagated. They are simply good strains, though probably they are better than stock propagated without any selection. However, there is every reason to believe that equally good, possibly better, strains may be found in many producing orchards. Whether any particular strain is inferior, superior, or just average can be determined only by careful tests.

HEALTH AND HEALTH SERVICES IN THREE MICHIGAN COMMUNITIES

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COMMUNITIES do not have a full or equal measure of facilities or services to maintain health. The factors which affect it are too numerous and variable for such a condition to prevail. Age composition of the population, economic status, and health practices of families are important influences in this connection. Also, health services such as medical doctors, hospitals and public health activities do not exist uniformly among all communities.

The extent of good health or the opposite, ill health, is not definitely known in either rural or urban communities. Statistics concerning health and health care are usually compiled on a county and state-wide basis and pertain to specific diseases or to specific health practices. They do not relate to local communities as ecological and social units nor do they indicate the amount of unsatisfied need which the people in any particular community may have.

The purpose of this article is to examine the problem of health and health care in the community, that is, the population of a town and its adjacent rural trade area. The specific purposes of the study are as follows:

1. To ascertain the extent of ill health as indicated by need for medical attention in each community.

2. To determine relationship between ill health and certain socio-economic factors such as income and place of residence.

3. To determine the extent to which residents of the respective communities use available medical services and the opinions they have concerning such services.

[1]This study was made in cooperation with the Community School Service Program of the Michigan State Department of Public Instruction. Dr. Edgar A. Schuler, Dr. J. F. Thaden, and Dr. Duane L. Gibson of the Social Research Service assisted in planning and carrying out the detailed activities of the project apart from family interviewing. The interviewing was done by Mr. Linwood Hodgdon, a graduate student at Michigan State College, his wife, Candis Hodgdon, R.N., and the author of this article.

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THE COMMUNITIES SELECTED FOR STUDY

Three town-country communities in Michigan were selected for the study. Included in this sample were Mesick (Wexford County) in the northern part of the lower peninsula, Stephenson (Menominee County) in the extreme southwestern part of the upper peninsula and Concord (Jackson County) in the central part of the lower peninsula.

Mesick is a small town having a population of 337. The town and its trade area include a total population of about 1,500. The population of Stephenson is 612 and that of a smaller town, Daggett, near Stephenson is 283. The population of its trade area is estimated to be 5,950. The total population of that community would thus be 6,845, or approximately 7,000 persons. The United States Census reports a population of 618 for Concord in 1940. Its trade area has an additional population of 1,134. Hence its total population is 1,752.

At the time the study was made, Stephenson and Concord had one or more medical doctors who practiced in their respective communities, but in Mesick the only doctor was an elderly man who had retired from active practice. None of the communities had a hospital, but hospitals did exist in adjoining communities within a distance of 25 miles. Concord and Stephenson each had a dentist. This service was not available in Mesick.

METHOD OF STUDY

The survey method was used to obtain data from a fairly random sample of families in each of the three communities. To acquire information about the health status and the need for medical attention among the people the "symptoms approach" technique was used. This technique consists of questioning informants concerning 27 symptoms which are included as part of the survey schedule. They are the kind of symptoms a physician usually looks for when taking a medical history. In the opinion of medical doctors who cooperated in making the list, every symptom, if present, constitutes a medical need at least to the extent that the advice of a doctor should be sought regarding the matter.[2] The remaining parts of the

[2]This list of symptoms had been previously validated by having a random sample from 306 Michigan farm families for whom data had been obtained receive a medical examination. There was an agreement between the schedule data and the medical examination regarding the need for medical attention in 8 out of 10 cases. A detailed account of the experiment is presented in Journal Article No. 864 (n. s.), Michigan Agricultural Experiment Station, Charles R. Hoffer and Edgar A. Schuler, Michigan State College, in cooperation with Rosalie Neligh, M.D., and Thomas Robinson, M.D., University of Michigan Medical School, "Determination of Unmet Need for Medical Attention Among Michigan Farm Families," *The Journal of the Michigan State Medical Society, 46:* 443-46, April 1947.

schedule contained questions about the use families made of medical and hospital services, the attitudes they had regarding medical service in their respective communities and certain facts of a socio-economic nature about each family.

A total of 433 families were included in the survey. In Concord 51 families in the town and 53 in the country were interviewed. These were selected in a random fashion so that 1 family in each 4 was contacted in the town and 1 family in each 6 in the country. Of the 118 families in the Stephenson community, 53 lived in town and 65 in the open country. Here 1 family in each 6 in the town and 1 in each 25 in the open country provided the information. In Mesick, all town families, a total of 112, were interviewed, while 99, or one-third, of those in the country constituted the sample. In Mesick the field work was done in December 1946. In Stephenson and Concord this part of the study was completed in June and July 1947.

EXTENT OF NEED FOR MEDICAL CARE

A basic assumption in the study was the idea that any one of the 27 symptoms, if reported to be positive, would constitute a need for medical attention at least to the point of diagnosis and possible treatment. If a medical doctor had not been consulted about a positive symptom it was considered as an unmet medical need.

The proportion of individuals in the various communities that had one or more unmet medical needs is shown in Table 1.

By totaling the percentages in rows c, d and e in Table 1, it is evident that 40.4 percent of the individuals in the sample population residing in the open country had one or more unmet medical needs (as defined in the purposes of the study), and that the corresponding percentage for town residents was 28.5 percent. Equally important from the standpoint of community organization is the fact that in each of the three communities the percentage of unmet need for medical care was higher in the open country than it was in the town. The difference between the town and country residents in Concord was 15 percent and in Stephenson 14.4 percent. In Mesick the difference was only 11 percent, probably because medical services were lacking for both town and country groups. Likewise, the percentage of the population that had no positive symptoms or had all positive symptoms treated by a medical doctor (rows a and b in Table 1)

TABLE 1—*Percentage distribution of individuals in three Michigan communities by specified individual level of health and health care, 1947**

Level of health and health care	Concord		Stephenson		Mesick		Total for the three communities	
	Town	Country	Town	Country	Town	Country	Town	Country
Totals: Number	148	189	190	238	355	377	693	804
Percent	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No unmet need Higher level								
a. No positive symptoms	65.0	54.0	56.9	53.5	44.0	39.0	52.0	47.7
b. One or more positive symptoms treated by M.D	22.0	18.0	23.7	13.0	16.0	10.0	19.5	12.9
One or more unmet needs Lower level								
One or more positive symptoms untreated by M.D.								
c. Some positive symptoms untreated, others treated by M.D	2.0	8.0	7.4	7.7	12.0	12.0	8.5	9.7
d. Some positive symptoms untreated, others treated by non-medical practitioner, others treated by M.D	6.0	2.0	1.0	**	1.0	2.0	2.0	1.6
e. All symptoms untreated or treated by home remedies only	5.0	18.0	11.0	25.8	27.0	37.0	18.0	29.1

*Individual level of health and health care is determined by type of medical care received when one or more positive symptoms is reported for an individual. Four individuals in the total of 1501 were not included in the calculations of this table

**Less than one-tenth of one percent.

was higher in the town than in the open country in each community. The difference in favor of town residents was 15 percent in Concord, 14.1 percent in Stephenson and 11 percent in Mesick.

AN ESTIMATE OF THE NEED FOR MEDICAL ATTENTION IN EACH COMMUNITY

With the percentage listed in Table 1 as a basis, it is possible to calculate, within the limits of statistical variation due to sampling, the total need for medical care in each community. In Concord one family in each four in the town and one in each six in the trade area were interviewed. Among these sample families, 52 persons in town and 88 in the country had need for medical care during the 6-month period preceding the interview. Consequently, if the number of

town residents be multiplied by 4 and that for the country by 6 it follows that a total of 736 persons (42.2 percent of the total population) in the community had need for medical attention. Following a similar method of computation, but using only the number of individuals who had one or more unmet medical needs, it becomes evident that 396 persons (22.4 percent of estimated population) in the community had unmet medical needs in the 6-month period preceding the survey.

In Stephenson, where 1 family in each 6 in the town and 1 family in each 25 in the country were interviewed, similar calculations showed that 3,267 persons, 47.9 percent of the total estimated population, had need for medical attention. The percentage of the total estimated population having one or more unmet medical needs was 32.2 percent. In Mesick, which was less well provided with medical service than the other communities at the time of the survey, 88 percent of the estimated population had need for medical attention during the period of 6 months preceding the interview, and 82.2 percent of the population had unmet medical needs, as indicated by the list of symptoms used in this survey.

PREVALENCE OF SYMPTOMS DENOTING NEED FOR MEDICAL ATTENTION

As explained in the preceding section a total of 27 symptoms was used to determine the extent of medical need for each individual. It is of interest to note the distribution of the frequency of occurrence of the symptoms among the persons included in the survey. The data pertaining to this matter appear in Table 2. They indicate that certain symptoms, such as poor vision, persistent pains in the joints, persistent backache and severe shortness of breath after doing light work, are the most prevalent. These symptoms are chronic in nature and hence the individual "lives with them," so to speak. It does not follow, however, that they are unimportant, because such symptoms may still cause discomfort and reduce the efficiency of the individual. In fact, all of the symptoms, even those which occur infrequently, are significant for the individual's health and well-being. According to the opinion of medical doctors who help select the list, any symptom, if neglected, may be a hazard to the health of the individual.

The methods used to treat the various symptoms are shown by

TABLE 2—*Number and percent of persons in each community reporting designated symptoms within a period of 6 months preceding the survey, 1947*

Symptom	Concord (337 persons in sample)		Stephenson (428 persons in sample)		Mesick (736 persons in sample)		Total for three communities 1501	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Poor vision for distant or close work, e.g., reading	28	8.3	39	9.1	91	12.4	158	10.5
Persistent pains in joints	20	5.9	39	9.1	88	12.0	147	9.8
Toothache	24	7.1	31	7.2	56	7.6	111	7.4
Repeated or persistent backache	20	5.9	21	4.9	69	9.4	110	7.3
Severe shortness of breath, after doing light work	20	5.9	19	4.4	65	8.8	104	6.9
Unable to chew food: teeth "sore" or missing	19	5.6	17	4.0	60	8.2	96	6.4
Persistent headaches	17	5.0	17	4.0	61	8.3	95	6.3
Unexplained tiredness: regularly	8	2.4	21	4.9	63	8.6	92	6.1
"Rupture", hernia or wearing of truss	14	4.6	19	4.4	49	6.7	82	5.5
Repeated or prolonged pains in the stomach or anywhere in the abdomen	21	6.2	12	2.8	44	6.0	77	5.1
Persistent skin rashes or itching of skin: "breaking out" (one week or more)	8	2.4	18	4.2	43	5.8	69	4.6
Accidental injuries: broken bones, head or severe injuries, accidental poisoning, snake bites, etc	5	1.5	12	2.8	40	5.4	57	3.8
Persistent cough (except colds in chest)	7	2.1	4	0.9	40	5.4	51	3.4
Continued loss of appetite	11	3.3	9	2.1	28	3.8	48	3.2
Repeated or persistent swelling of ankles (two weeks or more)	12	3.6	4	0.9	26	3.5	42	2.8
Asthma or hay fever	8	2.4	4	0.9	27	3.7	39	2.6
Sore mouth: due to plates or bridges	6	1.8	13	3.0	18	2.4	37	2.5
Persistent pains in chest	6	1.8	8	1.9	23	3.1	37	2.5
Unexplained loss of weight: persons over 18: 10 pounds or more in past 6 months. Persons under 18: any unexplained loss of weight	4	1.2	7	1.6	26	3.5	37	2.5
Repeated or frequent bleeding gums	7	2.1	3	0.7	26	3.5	36	2.4
Repeated nosebleeds not due to blow or injury	3	0.9	9	2.1	23	3.1	35	2.3
Fainting spells: stuttering, stammering, nervous breakdown, fits, convulsions	9	2.7	5	1.2	12	1.6	26	1.7
Lumps or discolored patches on skin	2	0.6	3	0.7	17	2.3	22	1.5
Running ear or ears: watery, bloody, pus	1	0.3	10	2.3	11	1.5	22	1.5
Coughing or spitting blood	9	2.7	1	0.2	5	0.7	15	1.0
Open or running sores that do not heal: leg or foot ulcers, others	3	0.9	1	0.2	11	1.5	15	1.0
Repeated vomiting: (several days or more)	4	1.2	3	0.7	7	1.0	14	0.9

TABLE 3—*Number and percent of individuals reporting positive symptoms who used designated methods of treatment*

Symptom	Number of persons reporting symptoms	Method of treatment					
		No treatment or home remedy only		Non-M. D.		M. D. (or dentist)	
		Number	Percent	Number	Percent	Number	Percent
Poor vision for distant or close work, e.g., reading	158	111	70.3	1	0.6	46	29.1
Persistent pains in joints	147	87	59.2	6	4.1	54	36.7
Toothache	111	67	60.4	0	—	44	39.6
Repeated or persistent backache	110	52	47.3	12	10.9	46	41.8
Severe shortness of breath: after doing light work	104	53	51.0	3	2.9	48	46.2
Unable to chew food: teeth "sore" or missing	96	80	83.3	2	2.1	14	14.6
Persistent headache	95	60	63.2	4	4.2	31	32.6
Unexplained tiredness: regularly	92	45	48.9	3	3.3	44	47.8
"Rupture", hernia or wearing of truss	82	43	52.4	1	1.2	38	46.3
Repeated or prolonged pains in stomach or anywhere in abdomen	77	33	42.9	3	3.9	41	53.2
Persistent skin rashes or itching of skin, "breaking out" (one week or more)	69	20	29.0	4	5.8	45	65.2
Accidental injuries: broken bones, head or severe injuries, accidental poisoning, snake bites, etc	57	12	21.1	4	7.0	41	71.9
Persistent cough (except colds in chest)	51	27	52.9	3	5.9	21	41.2
Continued loss of appetite	48	21	43.8	3	6.3	24	50.0
Swelling of ankles (two weeks or more)	42	23	54.8	1	2.4	18	42.9
Asthma or hay fever	39	17	43.6	2	5.1	20	51.3
Sore mouth: due to plates or bridges	37	31	83.8	0	—	6	16.2
Persistent pains in chest	37	15	40.5	3	8.1	19	51.4
Unexplained loss of weight. Persons over 18: 10 pounds or more in past 6 months. Persons under 18, any unexplained loss of weight	37	14	37.8	1	2.7	22	59.5
Repeated or frequent bleeding of gums	36	27	75.0	0	—	9	25.0
Repeated nosebleeds not due to blow or injury	35	24	68.6	0	—	11	31.4
Fainting spells: stuttering, stammering, nervous breakdown, fits, convulsions	26	12	46.2	4	15.4	10	38.5
Lumps or discolored patches on skin	22	17	77.3	0	—	5	22.7
Running ear or ears: watery, bloody, pus	22	10	45.5	0	—	12	54.4
Coughing or spitting blood	15	9	60.0	0	—	6	40.0
Open or running sores that do not heal: leg or foot ulcers; others	15	5	33.3	0	—	10	66.7
Repeated vomiting (several days or more)	14	4	28.6	0	—	10	71.4

the figures in Table 3. They indicate that "no treatment" or "home remedies only" are reported one or more times for every symptom, but this method was used more frequently for ailments which were chronic in nature. On the other hand, treatment by a medical doctor (or dentist for dental problems) was reported one or more times for every symptom.

It is obvious, therefore, that the standards of medical care varied among these families though the unavailability of medical service or lack of funds to pay for it may have prevented some individuals from receiving medical attention. Figure 1 shows the percentage of the sample population having positive symptoms and the percentage whose positive symptoms were untreated.

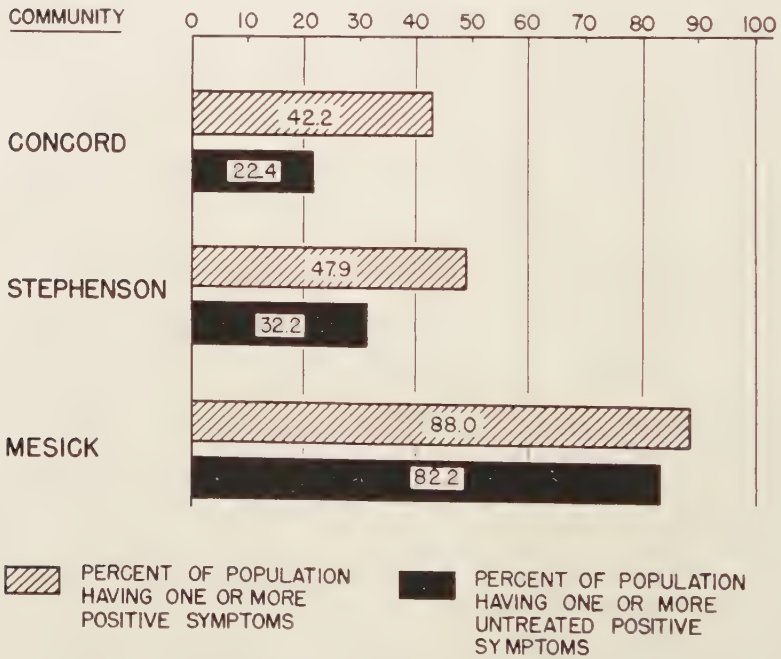

Fig. 1. The percentage of the estimated population in each community having medical needs (one or more positive symptoms) and the percentage having unmet medical needs (one or more positive symptoms untreated). The ratio of unmet needs to total needs provides an index of completeness of medical care in each community. In Concord this ratio was 0.53, in Stephenson 0.66, and in Mesick 0.93. The ratio decreases as the percentage of positive symptoms treated by a physician increases.

TABLE 4—*Number of individuals in each community losing designated number of days of work on account of illness during the 6-month period preceding the survey*

Days from work	Community						Three communities	
	Concord		Stephenson		Mesick			
	Number of individuals	Percent of total in survey	Number of individuals	Percent of total in survey	Number of individuals	Percent of total in survey	Number of individuals	Percent of total in survey
None	273	81	344	80.5	578	78.5	1195	79.7
1 – 9	35	10	49	11.4	79	10.7	163	10.9
10 – 19	13	3	16	3.7	31	4.2	60	4.0
20 – 29	2	1	3	.7	10	1.4	15	1.0
30 – 59	9	3	9	2.1	10	1.4	28	1.9
60 and over	5	2	7	1.6	26	3.5	38	2.5

DAYS LOST FROM WORK ON ACCOUNT OF ILLNESS

An indication of the seriousness of ill health from the standpoint of efficiency is made evident by the number of individuals who lost 1 or more days' work on account of illness. The extent of this loss for a period of 6 months in each of the three communities and for the total is shown in Table 4.

FACTORS ASSOCIATED WITH NEED FOR MEDICAL CARE

Age: It has been observed many times that as a population advances in age the number of ailments which create the necessity for medical attention increases. The population in the three communities under consideration seems to demonstate again this relationship. As a population becomes older, the positive symptoms become

TABLE 5—*Average number of positive symptoms per individual in the various age groups included in the sample for each of the three communities*

Age	Concord		Stephenson		Mesick		Total	
	Number of persons	Average number of symptoms	Number of persons	Average number of symptoms	Number of persons	Average number of symptoms	Number of individuals	Average number of symptoms
Under 10	64	.11	52	.27	158	.44	274	.33
10 – 19	55	.44	38	.50	125	.67	218	.58
20 – 29	38	.63	25	.40	66	1.27	129	.91
30 – 39	40	.80	39	.87	96	1.24	175	1.06
40 – 49	36	.94	21	1.14	66	1.62	123	1.34
50 – 59	40	1.40	20	1.85	84	2.00	144	1.81
60 – 69	33	1.70	28	1.50	85	3.08	146	2.47
70 and over	31	1.68	10	1.10	38	2.42	79	1.96
Not reported	—	—	5	—	18	—	23	—

TABLE 6—*Number and percent of individuals in designated income groups reporting one or more positive symptoms*

Gross cash income (1947)	Concord			Stephenson		
	Number of individuals	Percent having 1 or more positive symptoms	Percent of those having symptoms who were treated by an M. D.	Number of individuals	Percent having 1 or more positive symptoms	Percent of those having symptoms who were treated by an M. D.
Under $1000....	49	59	34	69	62	25
$1000–$2000....	81	49	55	165	43	43
$2000–$3000....	102	31	44	126	40	52
Over $3000....	93	37	58	51	37	53
Not Reported..	12	—	—	17	—	—

more numerous. The increase is especially evident after the age period 50-59 is reached. The detailed figures are presented in Table 5.

Gross Income: Families with low incomes generally have more illnesses and less medical care than those in the higher income brackets. Tabulations were made to ascertain whether there was evidence of these relationships among the families in the communities under consideration. The essential data are presented in Table 6.[3] The figures show that, in general, as the gross cash income increases, the proportion of individuals having positive symptoms decreases. Also, among those reporting positive symptoms, the percentage whose symptoms were treated by a medical doctor increases as the income rises.

Housing Facilities and Need for Medical Care: Tabulations using the family as the unit were made to determine what relationship existed between certain housing facilities and need for medical care. The data for families in the three communities combined are presented in Table 7. Again the expected relationship appears. There is more need for medical attention among families who do not have running water and inside toilets than there is among families whose houses are provided with these facilities. The percentages for no positive symptoms and one or more positive symptoms each treated by a medical doctor were tested by a statistical formula to find out if the differences between the percentages for those having a housing facility and those not having it were due to chance. The results showed that the differences were greater than could be attributed to chance only.

[3]Only data for Concord and Stephenson are included in this table. Corresponding tabulations were not made for Mesick. A tabulation of data for Mesick using the family instead of the individual as the unit showed similar relationships.

TABLE 7 — *Need for medical care among families having designated housing facilities*

Housing facilities	Families reporting		No positive symptoms, percent	One or more positive symptoms treated by M. D., percent	Some positive symptoms untreated, others treated by M. D., percent	Some positive symptoms untreated, others treated by non-medical practitioner, others by M. D., percent	All symptoms untreated or treated by home remedies only, percent
	Number	Percent					
Have running water	124	100	22	32	27	6	13
Do not have running water	98	100	12	27	30	7	24
Have inside toilet	94	100	24	31	27	7	11
Do not have inside toilet	128	100	14	28	30	5	23

HEALTH SERVICES

Medical Services: At the time the survey was made, the Concord community had one medical doctor and one dentist. Also, one osteopathic doctor was practicing there. The estimated population of the community was 1,752. This is a large number for one medical doctor. One doctor for a population of 1,000 is usually considered to be a reasonable number. All of the larger communities, however, which were 20 to 25 miles from Concord, had medical doctors and some of the families in Concord went to Jackson, Albion, or elsewhere for medical service.

In the Stephenson area, there were four medical doctors—two in the town of Stephenson and two in Daggett near Stephenson. One of the four was an elderly man who had reached a retirement status. Since the estimated population of the area is 7,000, it is obvious that there are approximately 2,300 persons per active physician. There were no osteopathic physicians in the area. Only a few of the families living in the outlying parts of the area went to doctors in other communities. There was one dentist in the area.

Medical service in the Mesick community was even less satisfactory. The estimated population of the community was about 1,500. The only doctor in Mesick was an elderly man who had retired. Though he practiced as much as he could, residents of that community had to go elsewhere for most of the medical care they received. The community did not have a dentist.

TABLE 8—*Distance to a medical doctor for families living in the open country in each of the communities surveyed*

Miles	Concord		Stephenson		Mesick	
	Number	Percent	Number	Percent	Number	Percent
0– 9	65	100	44	68	128	61
10–19	0	0	17	26	73	35
20–29	0	0	4	6	9	4
30–39	0	0	0	0	1	(–)*

*Less than 1 percent.

Distance to a Doctor's Office: One indication of medical service for a rural family is distance to a doctor's office. This factor for the three communities under consideration is shown in Table 8.

It appears from the figures in Table 8 that a majority of the families lived less than 10 miles from a doctor's office. In these days, when the use of the automobile is so general, such a distance would seem not to be excessive. About a third of the families in the Mesick community and one-fourth of those in the Stephenson area were 10-19 miles from a doctor's office. A total of 14 families were more than 20 miles from this service. Only in the Mesick community, however, was it necessary for a family to go to a town other than their regular trade center to see a doctor.

Inquiry was made to determine the proportion of families having what they considered a family doctor. In Concord this kind of relationship was most general, because 91 percent of the 104 families reported a family doctor. In Stephenson the corresponding percentage for 118 families was 86.4. In Mesick, where 211 families resided, it was 77.8.

Regardless of what a family may choose to do or how far it may live from a doctor's office, occasions will arise when it is necessary to see a doctor. Therefore, inquiry was made regarding the use of medical service by the families included in this survey. In each instance the family was asked how long it had been since any member had consulted their family physician. The results of this inquiry are presented in Table 9.

The figures in Table 9 clearly indicate that most of the families did find it necessary or advisable to consult a doctor within less than 1 year from the time of the survey. On the other hand, a few, either

TABLE 9—*Length of time since one or more members of the family consulted their family physician*

	Concord community*		Stephenson area		Mesick community	
	Number	Percent	Number	Percent	Number*	Percent
TOTAL	96	100	102	100	211	100
Less than 1 year	83	87	64	64	98	47
1 –2 years	7	7	20	20	12	5
2 – 3 years	2	2	6	5	4	2
3 – 4 years	0	0	5	5	2	1
4 years and over	2	2	6	5	95	45
Not reported	2	2	1	1	—	—

*Doctors in addition to family doctor were included.

because of neglect or good luck, got along for several years without having any of their members see a doctor.

The second approach in obtaining a measure of use of medical service was to ask how many times each member of the family had consulted a doctor in the 6-month period preceding the survey. This information was obtained for a total of 765 individuals in the Concord and Stephenson communities[1] and is presented in Table 10. The figures make it clear that about two-fifths of the 765 individuals in the sample consulted a doctor at least one time during the period of 6 months. Ninety individuals had consulted a doctor five or more times.

TABLE 10—*Number of times residents in the Concord and Stephenson areas visited a doctor in 6 months preceding survey*

Number of times a doctor was consulted	Concord				Stephenson				Both communities	
	Open country residents		Town residents		Open country residents		Town residents		All residents	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
None	117	62	77	52	182	76	98	52	474	62.0
1	28	38	27	18	15	6	41	22	111	14.5
2	14	15	7	5	14	6	17	9	52	6.8
3	4	2	6	4	9	4	8	4	27	3.5
4	3	2	3	2	2	1	3	2	11	1.4
5 or more	23	22	28	19	16	7	23	12	90	11.8

[1]The question about number of times each member of the family had consulted a doctor during the period of 6 months preceding the survey was not asked of families in the Mesick community.

OPINIONS OF INFORMANTS ABOUT MEDICAL SERVICES IN THEIR COMMUNITIES

Opinions of the informants regarding medical services available to them were ascertained by asking the question: "Was the medical services available in this community 'good', 'poor', or are you uncertain about the matter?" The responses to the question are summarized in Table 11.

TABLE 11—*Opinion of informants regarding medical services in their communities*

Community	Number of families	Opinion regarding medical service		
		Good	Uncertain	Poor
		Percent	Percent	Percent
Concord	104*	91	2	1
Stephenson	118	86	4	10
Mesick	211	22	27	51

*Six families in this community did not give an opinion

The basis of these opinions varied. In general, the informants were inclined not to be critical of the kind of service they received, since if they did not feel satisfied with one doctor, they would go to another or would neglect seeing any doctor. The most frequent reason for judging medical service to be poor was the lack of its availability. This is well illustrated in the responses of informants in Mesick. Over half of the people there thought the medical service was poor because the community had no doctor except the one who had retired from active practice on account of age. A few informants also judged the medical service as being poor because they thought the doctors were too busy and consequently they had to wait an unduly long time at a doctor's office before they could see him.

Method of Paying for Medical Services: When the survey was made, the informants were asked whether the family had insurance for paying doctor bills or whether they followed the customary plan of paying for medical service after it was received. The replies showed that a majority in each community paid for medical service after it was received. In Concord, 20 families (19 percent of the total) had insurance for paying a part or all the medical bills for one or more members of the family. In Stephenson, 18 families (15 per-

cent of the total) had a similar arrangement for paying medical bills. In Mesick, 46 families (21 percent of the total) had made such plans. In almost every instance the family had the insurance because the employer of the breadwinner (usually the husband) had made it possible for the family to get insurance through a group payment plan.

DENTAL NEEDS AND DENTAL CARE

Among the questions pertaining to symptoms, four related to dental problems. Obviously they were not a complete list of symptoms that might occur in connection with dental care. Rather they were the more common symptoms which could be determined by the person himself. The four symptoms were toothache; inability to chew food because of "sore" or missing teeth; sore mouth due to bridges or plates; and repeated or frequently bleeding of gums. The extent of these symptoms among the families interviewed is shown in Table 12.

The fact that these symptoms occurred in about the same proportion in each of the three communities indicates that the need for more dental care is a general one. As explained earlier, there was a dentist in Concord and one in Stephenson. Mesick had no dentist. A certain proportion of the families in each community went outside the trade center to receive dental service. Obviously this was necessary for all Mesick families, but in Concord and Stephenson a certain number of families would go to a particular dentist in another community if they liked him. Only 13 families in Concord stated that they were unable to see a dentist when they wanted to. In the Stephenson community also, 13 families made the same complaint. In Mesick, 33 families were unable to get a dental appointment when they wanted one. It was necessary, they explained, to wait from 2 to 6 months for an appointment.

TABLE 12—*Number and percent of individuals having designated dental needs*

Symptom	Concord community (339 persons)	Stephenson area (438 persons)	Mesick community (736 persons)
	Percent	Percent	Percent
Toothache	7	7	7
Unable to chew food: sore teeth or missing teeth	5	4	8
Sore mouth due to bridges or plates	1	3	2
Repeated or frequent bleeding gums	2	*	3

*Less than 1 percent.

HOSPITAL SERVICES

None of the communities had a hospital. Consequently it was necessary for families needing this service to go to other communities. Concord families usually went either to a hospital in Jackson or Albion, cities which are not more than 20 or 25 miles from any home in the community. In Stephenson most of the families needing hospitalization used the Menominee hospital, which is about 25 miles from the town of Stephenson. In Mesick the families had to go to Cadillac, which is about 20 miles from Mesick, or to some other community which would be even farther away.

In Concord, a total of 30 families had one or more members who had been admitted to a hospital within a year preceding the survey. In Stephenson, 32 families had a need for hospital service.[5] Only one family in the Concord community and three in Stephenson stated that it was not possible to get into the hospital when they wanted to. The reason given for not being admitted was the fact that when the person wanted to go to the hospital there was no room except for emergency cases.

The practice of having insurance for a part or all of the hospital bills which a family might incur was much more frequent than insurance for paying doctor bills. The figures pertaining to this matter are presented in Table 13. In most instances the insurance was taken out in connection with the employment of the husband. A majority of the families felt that insurance or prepayment plans for paying hospital bills were a good idea.

TABLE 13—*Percentage of families in each community having hospital insurance for one or more family members*

Community	Number of families	Percent having insurance for hospital care for one or more family members
All communities	433	32
Concord	104	47
Stephenson	118	26
Mesick	211	27

[5]The number of families using a hospital was not ascertained in the Mesick community.

TABLE 14—*Percentage of persons over 3 months and under 16 years of age vaccinated for smallpox, diphtheria and whooping cough in areas surveyed*

Area	Number of persons	Percent vaccinated for:		
		Smallpox	Diphtheria	Whooping cough
Concord community	103	78	82	56
Stephenson area	137	81	89	57
Mesick community	256	68	59	31*

*Twenty-seven percent were not vaccinated but had had the disease.

PUBLIC HEALTH SERVICES

Two types of activities which come within the scope of public health programs were included in the questions asked of the families interviewed. One pertained to vaccinations for smallpox, diphtheria and whooping cough. The other related to examination by a county public health officer or nurse.

The essential data about vaccinations are presented in Table 14. The figures show that considerably more work needs to be done in this aspect of public health work if all children within the age limits designated in the table are to be vaccinated.

The results pertaining to the second question regarding public health services showed that 17 percent of the families in the Concord community had children who were examined by a county public health officer or nurse during the year preceding the survey. In Stephenson, the percentage was 18. In the Mesick community, 22 percent of the families reported such a contact with the public health service.

CONCLUSIONS

This survey of health and health facilities in three Michigan town-country communities shows that there were unmet needs for medical care in each one. The percentage of individuals having unmet medical needs was higher in the open country than in the towns. There seemed to be a relationship between the amount of unmet need for medical care and the lack of medical service in the community—the community not having a physician (except one who had retired) consistently had a higher percentage of unmet needs than did the other communities which had resident physicians.

The need for medical attention as determined by the number of positive symptoms reported for individuals increased with the age of the population. Also, the percentage of the population having positive symptoms increased as the gross income of the family became smaller.

The use of medical services varied. In two communities, about two-fifths of the individuals included in the sample had visited a doctor at least once during a period of 6 months preceding the time of the interview. Generally speaking, informants were satisfied with the service of physicians but many were dissatisfied with its availability. They felt that many times the doctors were too busy and consequently they had to wait an unduly long time in their offices.

Approximately one family out of each three had at least one person who had been hospitalized during the year preceding the survey. About one-third of the families had hospital insurance for one or more members of the family. A majority of the families thought that insurance or prepayment plans for hospitalization were a good idea.

The study shows a definite need for more public health work in the communities.

HOW MICHIGAN FARMERS USE POULTRY MARKETING INFORMATION

By CLARA HENNING LOWE and REX KING[1]
SECTIONS OF SOCIOLOGY AND ANTHROPOLOGY AND ECONOMICS

MICHIGAN poultry farmers must have available, be acquainted with, and make use of accurate and adequate information about marketing conditions in order to get the best price for the products they sell. Only when farmers are satisfied that they are receiving a fair price for their poultry products can the consumer be assured of an adequate flow of the poultry commodities needed.

PURPOSE AND METHODS

In order to determine the farmer's use of and reaction to market news information, questionnaires were constructed around four questions which were regarded as important in a study of effective dissemination of market information. These questions were:

1) What knowledge do farmers have about the available sources of market information?

2) What sources of information about market conditions do they customarily use?

3) How adequate and useful do they consider the available market information to be?

4) What suggestions do they have for improving the reporting of market conditions?

Since a farmer's use of poultry market news and information may be influenced by the size of his poultry flock, his marketing methods and his market outlets, questions designed to determine these and

[1]This article deals with one phase of a cooperative research project in which the Section of Sociology and Anthropology, represented by Edgar A. Schuler, Duane L. Gibson, and Clara H. Lowe, and the Section of Economics, represented by Henry E. Larzelere and Rex King, are participating, and to which the Section of Poultry Husbandry, represented by C. G. Card, Charles C. Sheppard, and others, has given very great help. This preliminary report was written by the two graduate research assistants, Mrs. Lowe and Mr. King, but the study at every point involved joint effort and constant collaboration.

other related factors were included in this survey. The relationship of these factors to use of market news will be presented in the final report.

To develop a suitable sample of informants for the study, a mailing list of representative Michigan farmers was obtained from the U. S. Bureau of Agricultural Economics.[2] It was expected that a wider range of types of poultry production would be obtained if questionnaires were mailed to all farmers in the sample rather than only to those who were primarily poultry producers.

Every one of the 349 farmers on the B. A. E. mailing list was reached either by mail or personal interview. Of these, 121 farmers had sold eggs and/or chickens the previous year and would logically be expected to be interested in market information.

THE POULTRY ENTERPRISE ON THE FARMS STUDIED

It was found that of the 121 farms reporting chickens, 51 percent had fewer than 100 birds per flock, and an additional 24 percent of the flocks contained more than 100 but fewer than 200 birds. Twenty percent of the farms had over 200 birds per flock, and the rest either had no chickens at that time or did not answer the question. These figures, however, must be considered in relation to the season; most of the questionnaires were completed during March, when chicken flocks tend to be at their smallest. Forty-four percent of these returns reported that the wife handled the marketing of the eggs and poultry, and in another 16 percent of the cases she helped her husband with the marketing. In about 25 percent of the cases the husband did the marketing. Other members of the family and hired help accounted for another 10 percent of the farms.[3]

The most popular breed reported was the single-comb White Leghorn. Thirty-three percent of the informants listed them as the major breed. White Plymouth Rocks were reported on 23 percent of the farms, and Barred Plymouth Rocks on about a tenth of the farms. New Hampshire Reds were fourth, being listed for about 6 percent of the farms. Crosses and hybrids were the leading breeds on another 6 percent of the farms. Other breeds or combinations of breeds were listed for about 9 percent of the farms reported.

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[2]This was a list of names and addresses of farmers in 22 counties chosen by the Bureau of Agricultural Economics as representative of the agricultural areas of Michigan for the 1947 Survey of Agriculture.

[3]Throughout this article there will be several places where the numbers given will not total 100 percent. The remainder are those who either did not answer, replied "don't know" or "none," etc.

Three-fourths of the 121 farmers said they obtained the major part of their poultry income during the past year from egg sales. Sales of chickens accounted for the major part of the poultry income on 18 percent of the farms. Other types of poultry, such as turkeys, geese, ducks, etc., were reported on only 18 farms, and in no case did these other types of poultry bring in any important amount of poultry income.

MARKETING PRACTICES

Among the 117 farmers who sold eggs during the past year, 35 percent graded their eggs for size at the farm and 28 percent checked their grading with an egg scale. Only 6 percent of these farmers candled their eggs for quality.

Twenty-seven percent of the 121 farmers sold most of their eggs to wholesale buyers. Another 27 percent sold directly to consumers, and 26 percent sold to retailers, such as local grocery stores. Hatcheries, hucksters, hospitals, and restaurants accounted for the rest of the sales outlets. This same question was asked of all the farmers as to their chicken sales with largely similar results. Thirty-three percent of the farmers sold to wholesalers (some of whom very likely were trucker-buyers), 23 percent sold directly to consumers, and only 8 percent sold to retailers. Other markets got a larger part of the total chicken sales than of egg sales.

Sixty-seven of the farmers replying had sold their eggs to the same buyer for 2 years or longer; an additional 19 farmers had sold to the same buyer for over a year but less than 2 years. The other 23 farmers who answered had sold to their current market for less than a year. Less than 28 percent of the farmers had their eggs picked up at the farm. But of the 33 farmers who either graded or candled their eggs, 18 said their buyers paid on the basis of the farm grading. Seventy-seven percent of the farmers who did not candle or grade their own eggs said their buyers paid them on a nest-run basis. About 10 percent of these farmers said their buyers sorted their eggs and paid for them on that basis.

Because the data for this survey were largely collected during March, it was expected there would not be many recent sales of chickens. Less than a fifth of the farmers showed that they had sold any chickens within the previous month. Fewer than 1 in 10 of the 121 farmers had sold more than 25 chickens within that period.

Of the 106 farmers who reported selling poultry at some time in the past year, 76 percent said they sold them as "live" poultry. Seven sold them as "drawn", and about four each sold them as "feather dressed" or as "feather dressed and drawn." Seventy-nine were paid for their chickens on a live-weight basis, and six each were paid on a feather-dressed or a drawn-weight basis. The others reported combinations of the above.

KNOWLEDGE ABOUT AND USE OF MARKET INFORMATION

It was assumed that data on farmers' attitudes toward selling prices would be helpful in a study of their use of market information, so this question was asked: "Do you generally set your own price, or do you take what you get?" Seven out of every 10 of these egg producers reported that they "had to take what they could get" while only 2 said that they set their own selling price. When our informants were asked the same question about their poultry sales, 6 out of every 10 of these farmers said that they had to take what they could get, and 3 reported setting their own price. Whether the majority of poultry and egg producers are actually in a situation where there is no competitive bidding for their product cannot be determined at this time. But it is significant that they *feel* that they are at this type of disadvantage when marketing their poultry products.

Better than 6 out of every 10 of the 121 poultrymen compared their selling price with some other price. Of these, about 4 out of the 10 used market quotations, 2 used local stores for comparisons, and the rest compared with other buyers, neighbors, or with several of the above-mentioned sources.

Of the poultrymen who compared their selling prices, 3 out of 10 used the radio as their source of information. Two used both newspaper and radio, and another 2 used only the daily paper. The remaining 3 in every 10 of these farmers either did not supply any information, or used combinations of sources, such as radio and neighbors, egg buyers and newspapers, farm papers, and radio, and so forth.

Of the poultrymen who compared their prices with other prices, 13 percent did not even know whether the quotations they consulted were wholesale or retail. About 50 percent of the farmers said that the quotations they consulted were wholesale, 21 percent reported

that the quotations they used were both wholesale and retail and 8 percent said that they used retail quotations only.

About half of the farmers who used market quotations as a basis for price comparison looked for a particular quotation. Of these, about two-thirds of the poultrymen looked for quotations which gave prices on eggs according to color. Particular size and grade quotations were also consulted by some of the poultrymen.

When asked to name sources of marketing information other than the source they now used, no additional sources were named by about half of the 121 farmers. Of those who did supply information, radio was the most often suggested with the daily newspaper next in line. The telephone, other buyers, local stores, and neighbors were also suggested.

Convenience was rated highest by the poultrymen when they were asked to state why they preferred to use their present source of market information. Other reasons for using their present source of market information were reliability and accuracy, speed of reporting current prices, and local quotations, in the order given.

The poultrymen who rarely or never used market quotations were asked to state why they did not use the information available. Three out of every 10 of these farmers did not answer the question at all, another 3 said they sold too few eggs to merit using the information, and one each answered, "no time," "have to take what we get," and "want retail prices, not wholesale." One in 10 of these had various reasons: "local buyers pay the same," "convenience of present source of price comparison," or "have trustworthy dealer."

SUGGESTIONS FOR IMPROVING MARKET REPORTING

When asked to make suggestions for improvement of the present marketing information, 32 percent of these poultrymen could not make suggestions as they did not consult radio or printed market information. Twenty-one percent used the question as an occasion to state some grievance they felt toward the farmers' place in the marketing setup as a whole and not in relation to the market quotations as they were available to them. Twenty-three percent did not answer the question at all. Twelve percent replied "none," "all right as is," "hadn't considered it" or "little use in changing." Four percent answered that they had "too few chickens." Only the 8 percent of the poultrymen remaining had any suggestions to offer. These in-

cluded the following: supply more local and district quotations; both wholesale and retail prices should be quoted; give retail prices; the grades should be broken into more categories for classification and pricing; and finally, weekly bulletins were desired.

CONCLUSION

In conclusion, it should be pointed out that this is a preliminary analysis. Further information regarding the use of poultry market information will be available when replies from the 1948 Survey of Agriculture in Michigan and from comparable questionnaires sent to turkey producers and to poultry dealers are analyzed. It will then be possible to amplify the present analysis, and test the reliability of the findings here reported.

JOURNAL ARTICLE ABSTRACTS

A Method for the Estimation of the Advancement of Vegetation by the Use of Daily Maximum Temperatures

PARTRIDGE, N. L.

Proc. Amer. Soc. Hort. Sci. 49: 7-14. 1947. [Journal Article 714 (n. s.) from the Michigan Agricultural Experiment Station]

Data comprising date of first blooms for peaches and daily maximum temperatures covering 24 seasons were used. Accumulations above various maximum temperatures ranging from 28° to 50° F. for periods beginning January 1, February 1, March 1 and April 1, respectively, and extending to the date of the first bloom of the peach, were calculated. The use of the coefficient of variability was an unsatisfactory measure of the approximation of the various indices to vegetation as indicated by peach bloom. A suitable means for evaluating the indices was determined and it was concluded that the accumulation could be commenced January 1, February 1 or March 1 without changing significantly the value of the resulting index. There was also a wide range of maximum temperatures of approximately equal value for bases. The use of an index calculated from a maximum temperature base of 40° F. commencing January 1 was suggested for Michigan conditions. Tables calculated on this basis for 26 seasons are given to illustrate the variation between seasons, the assumption being that the progress of vegetation will be rather closely correlated with these indices.

Effect of Soil and Seed Treatment with 2,4-Dichlorophenoxyacetic Acid on Germination of Seeds and Development of Seedlings

HAMNER, C. L., MOULTON, J. E., AND TUKEY, H. B.

Bot. Gaz. 107 (3): 352-361. 1946. [Journal Article 795 (n. s.) from the Michigan Agricultural Experiment Station]

The normal germination of many seeds can be affected by soaking in low concentrations of 2,4-D. Pronounced morphological changes occur when certain seeds are treated in solutions as low as 1 p.p.m. It is thus evident that certain germinating seeds and very young seedlings are much more responsive to the chemical than are more advanced seedlings and established plants. Not only can seeds of broad-leaved plants be killed with 2,4-D but seeds of many of the grasses can be destroyed when 2,4-D is applied in the soil. The toxic effect of 2,4-D in the soil persisted for about 3 weeks after which time it rapidly disappeared so that by the end of 4 weeks it was almost completely gone.

Hemoglobin Concentrations in the Blood of Normal and Estrogen-treated Turkeys

WOLTERINK, L. F., REINEKE, E. P., AND DAVIDSON, J. A.

Am. Jour. Vet. Res. 8: 431-436. 1947. [*Journal Article 801 (n. s.) from the Michigan Agricultural Experiment Station*]

The influence on the blood hemoglobin of diethylstilbestrol when given by injection and the dimethyl ether of diethylstilbestrol when given orally was determined in Standardbred Bronze, Broadbrest Bronze and Standardbred X Broadbrest turkeys.

As determined by the Sheard-Sanford Method, the normal hemoglobin concentration in the three varieties of Bronze turkeys between the ages of 21-28 weeks was 13 to 15 gm. per 100 cc.

Diethylstilbestrol suspensions injected into the neck wattle produced a marked anemia with large dosages and a mild anemia with smaller dosages.

The dimethyl ether of diethylstilbestrol given as 0.01 percent of the feed for 29 to 31 days reduced the hemoglobin concentration in the blood of turkeys to about three-fourths of the control values.

The Role of Vitamin A in Bovine Nutrition

LANGHAM, R. F.

M.S.C. Veterinarian. 6: 14-16, 31-34. 1946. [*Journal Article 819 (n. s.) from the Michigan Agricultural Experiment Station*]

This paper is a review of the literature on the role of vitamin A in the bovine.

The chief sources of provitamin A are good green grasses and hay, and yellow corn. Colostrum is one of the richest sources for calves.

The minimum requirement of carotene per day per kg. of body weight lies between 26 and 33 micrograms. The chief symptoms of vitamin A deficiency are night blindness, papillary edema, pityriasis, reproductive failure, dead and weak calves, retention of the fetal membranes, scours, pneumonia, increased cerebrospinal pressure, subcutaneous edema, and lameness. Thirty-five references were covered in the paper.

The Equilibrium Moisture Content of Alfalfa Hay When Exposed to Air at Various Relative Humidities

DEXTER, S. T., SHELDON, W. H., AND WALDRON, D. I.

Agr. Eng. 28 (7): 295-296. 1947. [*Journal Article 825 (n. s.) from the Michigan Agricultural Experiment Station*]

Samples of alfalfa hay, both dried and undried, were exposed to atmospheres of various relative humidities over sulfuric acid solution until an equilibrium of moisture content was attained. In general, molding occurred at relative humidities of 85 percent or higher within a period of 1 or 2 weeks. Samples high in protein appeared to absorb moisture more at high relative humidities than did samples lower in protein. Freshly harvested samples with cells still living maintained a far higher moisture content and molded more readily at high relative humidities than did samples dried before such exposure to high humidity.

Barn-dried alfalfa did not absorb moisture from air with a relative humidity of 80 percent, unless the moisture content of the hay was below 15 percent which is considered dry enough to keep in ordinary storage.

The Urinary Excretion of Riboflavin by College Women

Brewer, W., Porter, T., Ingalls, R., and Ohlson, M.

Jour. Nutr. 32: 583-596. 1946. [*Journal Article 830 (n. s.) from the Michigan Agricultural Experiment Station*]

The urinary excretion of riboflavin of 14 college women was studied under the following conditions: 1) self-selected diet; 2) usual diet supplemented daily with 3 mg. of riboflavin; 3) controlled diet at six riboflavin intakes; and 4) 24-hour excretion after a 3 mg. dose of riboflavin following each period of controlled intake. From three to nine subjects were studied at each of the following riboflavin intakes: 0.79, 1.04, 1.25, 1.62, 2.23, and 2.73 mg. daily.

Urinary excretion of riboflavin on self-chosen diets ranged from 144 to 850 mcg. per 24 hours. The average urinary riboflavin for the last three days of each period of controlled diet was, respectively, 0.07, 0.16, 0.13, 0.32, 1.18 and 1.31 mg. per 24 hours.

A study of the daily excretions and the excretion of the test dose after each dietary period indicated that 2.23 mg. were in excess of the needs of the subjects. Four subjects showed a sharp increase in urinary excretion of the test dose after an intake of 1.26 mg. and did not use additional vitamin to apparent advantage. For two subjects the data were incomplete but it appeared that the increase in excretion of test dose occurred between intakes of 1.26 and 1.62 mg. For four subjects the upper limit of intake which maintained tissue stores was not determined but an intake of 1.62 mg. seemed to approach this point.

All of the subjects were in good physical health throughout the experiment.

Discoloration of Potatoes after Cooking as Related to Their Composition

Bandemer, Selma L., Schaible, P. J., and Wheeler, E. J.

Amer. Potato Jour. 24 (1): 1-6. 1947. [*Journal Article 840 (n. s.) from the Michigan Agricultural Experiment Station*]

Moisture, ash, manganese, iron and pH were determined on Sebago, Chippewa, Green Mountain, and Russet Rural varieties of Michigan-grown potatoes and correlated with the degree of discoloration obtained after steaming.

The correlations between discoloration and moisture, between moisture and pH and between discoloration, moisture and pH were all highly significant within lots. That between discoloration and pH was significant within some lots. The discoloration increased with increased moisture and decreased pH.

The study indicated that moisture is a dominant factor in discoloration of cooked potatoes but its influence is upon some more directly involved component.

A Comparison of the Babcock, Gerber, Minnesota, Pennsylvania and Mojonnier Methods for Determining the Percentage of Fat in Homogenized Milk

Trout, G. M. and Lucas, P. S.

Jour. Dairy Sci. 30 (3): 145-159. 1947. [*Journal Article 841 (n. s.) from the Michigan Agricultural Experiment Station*]

Comparisons were made on the relative efficiency of the Babcock, Gerber, Minnesota, Pennsylvania, and Mojonnier methods for determining the percentage of fat in homogenized milk. The data indicated that:

Homogenization does not affect the Mojonnier fat test of milk.

The modified Babcock method (17.5 ml. of 1.835 sp. gr. sulfuric acid added in three portions, 8, 5, and 4.5 ml., respectively, and shaken for at least 2 minutes before centrifuging) may be used with much assurance of accuracy in testing homogenized milk. Twenty-four tests in duplicate averaged within −0.012 percent of those of nonhomogenized milk made by the same method and within +0.043 percent of the Mojonnier average.

Homogenization does not affect the Gerber test. The average Gerber tests, both of nonhomogenized and homogenized milk, were found to be 0.09 percent higher than those secured by the Mojonnier method. Aside from the necessity of introducing another test and the fact that the readings were approximately 0.1 percent higher than the Mojonnier, the Gerber test was by all odds the most satisfactory test studied for making fat tests of homogenized milk.

While the Minnesota method yielded average tests of homogenized milk within +0.027 percent of those of nonhomogenized milk, the tests varied from those of the Mojonnier on the average by −0.433 percent. It would seem, therefore, that the test could not be recommended for testing homogenized milk.

The Pennsylvania method, yielding tests on homogenized milk in these studies markedly lower than the Mojonnier method, cannot be recommended for testing homogenized milk.

The Effect of Soil Aeration, Moisture, and Compaction on Nitrification and Oxidation and the Growth of Sugar Beets Following Corn and Legumes in Pot Cultures

SMITH, F. W. AND COOK, R. L.

Soil Sci. Soc. Am. Proc. 11: 402-406. 1946. [*Journal Article 843 (n. s.) from the Michigan Agricultural Experiment Station*]

Sugar beets were grown in Brookston clay loam pot cultures following corn, alfalfa, and sweet clover. One-half of the cultures were excessively compacted. One-half of the pots in each compaction treatment were maintained at a moisture content equal to the moisture equivalent which was 25 percent. The other one-half were held at 28.2 percent moisture. Each compaction and moisture content treatment was still further divided on the basis of normal and forced aeration.

The degree of oxidation in the soil was determined by measuring ferrous and ferric iron and bacterial activity was measured by determining nitrate nitrogen in the soil.

Certain conclusions were evident from the results obtained. Excessive compaction greatly decreased sugar beet yields and the presence of excessive soil moisture magnified the detrimental effects of compaction. The compaction and excessive soil moisture caused disturbances in the oxidation and nitrification processes within the soil. Aeration was an important factor in the production of sugar beets. There was strong evidence that effective air capacity of the soil was an important factor. Inadequate aeration was more injurious to sugar beets following legumes than to beets following corn. Top growth cannot be taken as a measure of sugar beet yields.

A Greenhouse Study of Deficiency Symptoms in Sugar Beets with Details for the Preparation of Balanced Nutrient Solutions

WEIDEMANN, A. G. AND COOK, R. L.

Proc. Soil Sci. Soc. Am. 11: 361-368. 1946. [*Journal Article 844 (n. s.) from the Michigan Agricultural Experiment Station*]

A knowledge of symptoms of nutrient deficiency in plants is becoming a useful tool in the hands of agricultural workers who give advice to farmers regarding use of fertilizers. To become acquainted with the specific symptoms, which vary with the nutrient and the crop, good use has been made of nutrient solutions in sand cultures.

Sugar beets, an important crop in Michigan, were grown in nutrient solutions from which, in different treatments, various elements were singly omitted. Thus, characteristic symptoms were identified and are described.

The elements studied were nitrogen, phosphorus, potassium, calcium, magnesium, manganese, zinc, copper, boron and iron. The relatively insoluble salts such as $FePO_4 .4 H_2O$ and $CaHPO_4 .2 H_2O$ were mixed with the dry sand at the beginning of the experiment while the soluble salts were added in solution as the experiment progressed. Three trials were conducted. In the second and third trials the applications of certain salts were increased and other changes were made. In the first trial no attempt was made to maintain a certain rate of application of the different elements when making adjustments for omitting one element, but in the second and third trials the solutions were so balanced that each of the tested elements present, except iron, was maintained at the same concentration for all treatments. Methods, figures, and calculations are presented for making these balances.

During the progress of the experiments observations were made, and symptoms and other conditions recorded by figures and photographs. Finally, the plants were harvested, weighed and photographed.

During the growth of the plants it was found necessary to supply small quantities of nitrogen, phosphorus, potassium, calcium, magnesium and boron to keep the plants alive. In the later trials, where growth had been increased by heavier applications of the more essential elements, minor element deficiencies became more prevalent. The absence of iron caused serious deficiency symptoms and a reduction in yield. The absence of manganese resulted in deficiency symptoms but did not affect yields. No indication of copper and zinc deficiency occurred and yields were not retarded where these elements were omitted from the nutrient solutions.

Some Techniques Which Help to Make Greenhouse Investigations Comparable with Field Plot Experiments

COOK, R. L. AND MILLAR, C. E.

Soil Sci. Soc. Am. Proc. 11: 298-304. 1946. [*Journal Article 846 (n. s.) from the Michigan Agricultural Experiment Station*]

The results obtained from greenhouse pot culture experiments have been found to be greatly influenced by the techniques employed and by the environmental conditions under which the experiments were performed. By making use

of certain methods of procedure, good correlation has resulted between greenhouse and field results. This has been true in a rotation experiment where the greenhouse pots were filled with soil taken from the corresponding plots in the field. In fertilizer studies with sugar beets in the field, five farms were rated in the order of their response to fertilizers. In an experiment in the greenhouse, using soil from these farms, they fell in the same order, except that the last pair, those showing least response, was reversed.

Certain techniques help to make greenhouse investigations comparable with field plot experiments. In general, containers should be large. For many experiments 1- or 2-gallon jars are too small.

Nutrient levels, on an acre, must be much higher in the greenhouse than in the field. If growth is good, yields may be several times as high per unit surface area as in the field.

Generally, it is better to place fertilizer near the top of the soil column, close to the seed, than to place it deeper in the soil.

Irrigation at the top of the soil in the conventional manner has been shown to be better than the introduction of water at the bottom of the pot through glass tubes.

During a 4-year period, soil structure has been maintained by removing the soil from the pots when dry between crops and passing it through a 4-mesh sieve, then returning it to the pots in an air-dry condition.

Summer time temperature control has been made possible by use of an outdoor screened-in area. This has made it possible to grow healthy crops during seasons which are normal with respect to both temperature and length of day.

The Fog Machine for Applying Pre-harvest Drop Materials to Apple Trees

HAMNER, C. L. AND RASMUSSEN, E. J.

Am. Soc. Hort. Sci. Proc. 49: 78-80. 1947. [*Journal Article 853 (n. s.) from the Michigan Agricultural Experiment Station*]

The fog machine has been used successfully for the application of naphthalene acetic acid as a pre-harvest spray to prevent drop of Oldenburg apples. The naphthalene acetic acid in "fogging" treatment was slightly more effective in delaying the pre-harvest drop of Oldenburg up to 12 days after application than was the standard method of water spray application.

The Effect of Thiouracil on Efficiency of Gains and Carcass Quality in Swine

MCMILLEN, W. N., REINEKE, E. P., BRATZLER, L. J., AND FRANCIS, M. J.

Jour. An. Sci. 6 (3): 305-309. 1947. [*Journal Article 854 (n. s.) from the Michigan Agricultural Experiment Station*]

The effect of thiouracil fed as 0.1 percent of the ration on economy of gains and carcass quality was studied with Chester White, Yorkshire and crossbred market pigs.

Compared with the controls, five Chester White barrows averaging 162 pounds and fed *ad libitum* for 41 days on a ration containing thiouracil made 0.16 pound less daily gain, but required 13.8 percent less feed per unit of gain. Five Yorkshire pigs given thiouracil for the same period averaged 0.09 pound less daily

gain and required 18.8 percent less feed per unit of gain. Nine crossbred pigs fed thiouracil at a different season made 0.35 pound less daily gain and required 8.4 percent less feed per unit of gain than their controls.

All of the pigs in the experimental groups became lazy toward the end of the second week and became increasingly sluggish as the trial progressed. The greater increase in the economy of gain in the Yorkshires as compared with the Chester Whites is believed to be due to a higher natural thyroid secretion rate in the former and consequently a greater reduction in rate of metabolism under the influence of thiouracil. There were no significant differences in the carcasses attributable to the thiouracil treatment.

Results of Spraying and Dusting Potatoes in Michigan in 1946

MUNCIE, J. H. AND MOROFSKY, W. F.

Am. Potato Jour. 24 (6): 183-187. 1947. [*Journal Article 856 (n. s.) from the Michigan Agricultural Experiment Station*]

In the experiments at the Lake City Experiment Station, potatoes sprayed with Dithane-zinc sulfate-lime DDT and F48-Bordow-Dethyl gave yields significantly better than those of any other materials employed. It seems possible that lack of injury to the plants from these materials or this factor and the added effect of DDT may be responsible for the increased yields. Bordeaux mixture 8-12-100, Zerlate and Yellow Cuprocide Tribasic-DDT ground together and DDT alone resulted in yields higher than those of the other materials employed, although these differences in yield were not statistically significant in every case.

The results of the dusting experiments, using fixed coppers in comparison with monohydrated copper sulfate-lime showed no significant differences in yield between these materials plus DDT or DDT alone.

Considerable variation in yield was found between plots sprayed with the same materials in different counties in the upper peninsula. Using the plots of identical materials in each of three counties as added replicates of materials, there was no significant difference in yield between the various sprays.

Late blight was absent in the Lake City Experiment Station tests and early blight was present in only slight amounts. In the upper peninsula plots late blight was present in Menominee, Schoolcraft, Marquette and Houghton counties, but its development was stopped by early killing frosts before any appreciable damage resulted.

Trials of New Sugar Beet Varieties for Michigan

KOHLS, H. L.

Proc. Am. Soc. Sugar Beet Technologists. 112-114. 1947. [*Journal Article 862 (n. s.) from the Michigan Agricultural Experiment Station*]

Ten sugar beet hybrids were tested in comparison with a standard variety in two localities, Saginaw and Lenawee counties, in 1947. Previous trials were in Ingham County. These preliminary tests indicated that five hybrids were significantly higher in yields of sugar per acre than the standard variety U.S. 215 X 216 and were resistant to leaf spot.

The Influence of Domestic Ryegrass and Redtop upon the Growth of Kentucky Bluegrass and Chewing's Fescue in Lawn and Turf Mixtures

HARRISON, C. M. AND ERDMAN, M. H.

Jour. Am. Soc. Agron. 39 (8): 682-689. 1947. [*Journal Article 863 (n. s.) from the Michigan Agricultural Experiment Station*]

The four grasses were sown at various rates in pure culture and in mixture to test the competitive effects of the "nurse" grasses — redtop and ryegrass — on the establishment of bluegrass and fescue.

In mixture, both domestic ryegrass and redtop inhibited the growth of Kentucky bluegrass and Chewing's fescue. The ryegrass and redtop dominated the mixtures in which they made up 20 percent or more by weight of the mixture. This dominance did not diminish with time.

Where quick cover is not essential, sowing of an adapted, desired species alone would result in a more satisfactory turf than a mixture which includes the coarser, more aggressive nurse grasses.

Effect of Various Mulching Materials on Orchard Soils

TURK, L. M. AND PARTRIDGE, N. L.

Soil Science. 64 (2): 111-125. 1947. [*Journal Article 866 (n. s.) from the Michigan Agricultural Experiment Station*]

In the fall of 1939, an experiment, involving the use of lysimeters, was started for the purpose of studying the effect of different kinds of mulching materials on the accumulation of soil nitrates and the conservation of soil moisture. The surface soil (7 inches) of three soil types (Coloma sand, Hillsdale sandy loam, and Miami silt loam) was used, and mulches of alfalfa hay, straw, and straw plus ammonium sulphate were applied to each of the three soils; other lysimeters received no mulch. Additional mulches of peat, shredded corn stover, shredded corn stover plus ammonium sulphate, sawdust, shavings, and gravel were used on the Hillsdale sandy loam. Each treatment was made in triplicate and determinations were made of the quantity of water which percolated through the soils, the amount of nitrates produced, and the changes in exchangeable cations in the soils. With the exception of peat all mulches were effective in decreasing evaporation losses of water. The peat mulch had such a high absorptive capacity for water that with light rains or long intervals between rains very little water reached the soil. The quantity of nitrates produced in the unmulched soils was greater than in the mulched soils except where alfalfa was used and in those soils which had received straw mulch plus ammonium sulphate. The decrease in nitrate production under straw mulch and similar types of mulching materials is believed due to poorer aeration brought about primarily by a higher soil moisture content and to a somewhat lower temperature. In general, the least depressive effect on nitrate production occurred in the better aerated soil. Mulches such as alfalfa, straw, and corn stover contribute materially to the plant nutrient content of the soil.

The Effect of Pre-packaging and Refrigeration of Strawberries on the Water Loss, Spoilage, Vitamin C Content and Sugar-Acid Ratio of the Fruit

MOULTON, J. E.

Am. Soc. Hort. Sci. Proc. 50: 263-268. 1947. [*Journal Article 870 (n. s.) from the Michigan Agricultural Experiment Station*]

Wooden and paper quart boxes containing the Robinson variety of strawberry were wrapped in one of three different types of films (Cellophane, Pliofilm, and Cellulose acetate). One lot of fruit was stored under refrigeration for 3 days while a second lot was held at 80° F. for 2 days.

The appearance of the strawberries was improved by the use of a cap or overwrap of any one of the three films employed in these tests. Loss of moisture was decreased by the use of a relatively impermeable film like pliofilm, but temperature changes caused condensation of moisture within packages wrapped in this way. This moisture in turn favored softening and darkening of the fruit. There was little fogging of the film when cellulose acetate was used. The quality of the fruit as indicated by spoilage, mold counts, the vitamin C level, and sugar-acid analyses, was not appreciably affected by the type of film used, the method of wrapping the package or the material of which the box was made.

At 35° F., moisture loss, spoilage and molding of the berries were significantly reduced as compared with fruit stored at 80° F.

Better Quality Hay

DEXTER, S. T., SHELDON, W. H., AND HUFFMAN, C. F.

Agr. Eng. 28 (7): 291-293. 1947. [*Journal Article 871 (n. s.) from the Michigan Agricultural Experiment Station*]

A program for better hay demands better hay species, better fertilization and cutting practices, even on poorer species, and better curing.

The quality of the cured hay can be no higher than the quality of the material that passes over the mower cutter bar.

Immature hays are difficult to cure, but may have high feeding values.

From feeding trials with mow-cured and other hay, the conclusion is reached that hay quality is best preserved by rapid drying in the mow or in the field, and that protracted drying is detrimental, even though no mustiness occurs.

Weed Control with 2,4-Dichlorophenoxyacetic Acid and Related Compounds and Their Reduced Effect under Varying Environmental Conditions

JORGENSEN, C. J. C. AND HAMNER, C. L.

Bot. Gaz. 109 (3): 324-333. 1948. [*Journal Article 872 (n. s.) from the Michigan Agricultural Experiment Station*]

The residual effect of 2,4-D in the soil was studied under varying environmental conditions. There was no appreciable difference in weed seed kill by the acid, the sodium salt, or the methyl ester of 2,4-D applied to Coloma sand. Higher temperatures resulted in disappearance of toxicity of sodium salt of 2,4-D from the soil more rapidly than did freezing or sub-freezing temperatures. Differ-

ences in pH value of Coloma sand did not appreciably affect the rate of loss of toxicity under the conditions of the experiment. In water-saturated flats sodium salt of 2,4-D disappeared in 3 weeks while in air-dried flats toxicity was still present after 8 weeks. Corn was more highly resistant to 2,4-D materials under all conditions than either peas or radishes.

The Moisture Content of Various Hays in Equilibrium with Atmospheres at Various Relative Humidities

DEXTER, S. T.

Jour. Am. Soc. Agron. 39 (8): 697-701. 1947. [*Journal Article 874 (n. s.) from the Michigan Agricultural Experiment Station*]

Values for the equilibrium moisture content of various mature and immature hays at various relative humidities are given. It is shown that immature hays are higher in moisture content at high relative humidities than are mature hays. Molding was visible on all samples of hay and straw within 10 days at a relative humidity of 85 percent. The amount of mold development at 85-percent relative humidity was greater in immature hays than in mature hays or straws. The development and occurrence of molds was determined by the relative humidity of the atmosphere rather than by the moisture content of the hay. Thus, an immature hay at 17- or 18-percent moisture might show no sign of mold (at 75-percent relative humidity) when a mature hay at 15- or 16-percent moisture and a relative humidity of 85 percent was plainly molded. To avoid relatively prompt molding in any hay, the relative humidity of the surrounding atmosphere must be kept below 85 percent.

Listerellosis in Sheep of Michigan

GRAY, M. L., THORP, F., NELSON, R. H., AND SHOLL, L. B.

M.S.C. Veterinarian. 7: 161-163. 1947. [*Journal Article 879 (n. s.) from the Michigan Agricultural Experiment Station*]

Four cases of Listerellosis in sheep have been confirmed by isolation and identification of *Listerella monocytogenes*. Three cases, two ewes and a lamb, occurred in the same flock and the fourth case in a nearby flock. The infection in the ewes was manifested by a central nervous system disorder while the lamb displayed a typical septicemia. The cultures when injected intracerebrally into rabbits produced death in from 20 hours to 4 days. In all instances listerellae were isolated from the brain and liver. When instilled into the eye of rabbits it produced a marked keratitis and conjunctivitis within 36 hours which persisted for 4 days.

Physical Action of Surface-active Cations upon Bacteria

KIVELA, E. W., MALLMANN, W. L., AND CHURCHILL, E. S.

Jour. Bact. 55 (4): 565-572. 1948. [*Journal Article 880 (n. s.) from the Michigan Agricultural Experiment Station*]

The bacteriostatic effect of surface-active cations on bacterial spores can be reversed by dilution and shaking in distilled water or physiological saline solution.

The reversal of the bacteriostatic effect of surface-active cations by the removal of the cations adsorbed on the bacterial spores by dilution was proved by demonstrating that negative mobilities of the spores were restored by washing the cells with distilled water.

The high osmotic pressure exerted on the bacterial cell by the adsorbed surface-active cation may explain, in part, the destruction of vegetative cells by the discharge of cell fluids into the suspending solution.

Segregation in Russeted Sports of the Grimes Apple

GARDNER, V. R., TOENJES, W., AND GIEFEL, M.

Jour. Agr. Res. 76 (11): 225-229. 1948. [*Journal Article 883 (n. s.) from the Michigan Agricultural Experiment Station*]

Individual trees propagated from buds of russeted limb sports of the Grimes apple showed marked differences in the degree of russeting of their fruits. Some trees bore fruits rather uniformly russeted, like the parent limb sport; others bore fruits that uniformly showed almost complete reversion to the normal smooth Grimes; still others showed an intermediate degree of reversion. One tree, grown from a single bud of the parent limb sport produced limbs each of which bore fruits comparatively uniform in degree of russeting, but differing from each other. Thus there was limb-to-limb segregation and reversion in some daughter trees and whole-tree segregation and reversion in others.

Variability and Segregation in the Golden Russet Apple

GARDNER, V. R., TOENJES, W., GIEFEL, M., AND KREMER, J. C.

Jour. Agr. Res. 76 (11): 231-240. 1948. [*Journal Article 884 (n. s.) from the Michigan Agricultural Experiment Station*]

Numbered labels were attached to 5,000 fruiting spurs on two old Golden Russet apple trees in the fall of 1933. Their fruits were classified as to amount of russeting and each year for 6 succeeding seasons fruits borne by the same spurs were similarly classified. There was a wide range in degree of russeting any single season on each tree, though certain seasons were characterized by considerably more russeting than others. It was found that certain large branches, year after year produced fruits with significantly more or significantly less russeted fruits than did other branches on the same trees. Furthermore, some of the daughter trees propagated from selected branches of the parent trees similarly produced fruit with relatively little or relatively much russeting; still other daughter trees showed a wide range in amount of russeting, thus resembling the parent trees. The data are interpreted as indicating that the Golden Russet apple is a chimera in respect to fruit russeting.

Segregation in a Radially Unsymmetrical Sport of the Canada Red Apple

GARDNER, V. R., TOENJES, W., AND GIEFEL, M.

Jour. Agr. Res. 76 (11): 241-255. 1948. [*Journal Article 885 (n. s.) from the Michigan Agricultural Experiment Station*]

A large-fruited, radially unsymmetrical bud sport of the Canada Red apple is described. It is classified as a sectorial chimera. Topgrafts and nursery-grown

trees propagated from the parent sport produced fruits that for the most part were radially unsymmetrical. There were, however, a number of segregates which appeared to be constant. These included large-fruited, normal sized and small-fruited regular or radially symmetrical strains. The large-fruited, radially symmetrical strains appear to be valuable for commercial propagation.

Rumen Digestion Studies. I. A Method of Investigating Chemical Changes in the Rumen

HALE, E. B., DUNCAN, C. W., AND HUFFMAN, C. F.

Jour. Nutrition. 34 (6): 733-746. 1947. [Journal Article 886 (n. s.) from the Michigan Agricultural Experiment Station]

A critical appraisal of the lignin ratio method was made to obtain information on the rate of digestibility of various components in roughage. A theoretical and experimental basis for the calculation of the rumen digestion coefficients is presented. By the use of the suggested formulae, measurements can be made either of maximum digestion or the rate of rumen digestion. Lignin values form the basis of both of these procedures but are applied in two distinct ways. These methods are not suitable for determining digestion coefficients of mixed rations since concentrates are not only low in lignin but they also pass from the rumen more rapidly than roughages. The principles forming the basis for the rumen digestion calculations received special attention.

Rumen Digestion Studies. II. Studies in the Chemistry of Rumen Digestion

HALE, E. B., DUNCAN, C. W., AND HUFFMAN, C. F.

Jour. Nutrition. 34 (6): 747-758. 1947. [Journal Article 887 (n. s.) from the Michigan Agricultural Experiment Station]

Studies of the chemical changes in the bovine rumen show that during the first 6 hours after feeding there was rapid digestion of proteins and carbohydrates. The predominant phenomenon during the second 6 hours was a rapid disintegration of cellulose. The digestion of proteins and carbohydrates paralleled the digestion of cellulose. Rumen digestion came to a standstill within 12 hours after feeding and prolonged digestion periods up to 24 hours did not increase rumen digestion coefficients. Average rumen digestion coefficients for 8 trials at 12-14 hours after feeding were: dry matter 48.4, protein 59.6, nitrogen-free extract 65.2, crude fiber 27.2, cellulose 43.4, other carbohydrates 83.0 and lignin 3.1 percent. After plant fragments pass from the rumen variable amounts of lignin may be digested, thereby exposing varying amounts of cellulose and protein to further digestion. The caecum plays only a supplementary role in the disintegration of roughage in the ruminant. An average of 11.6 percent of the cellulose and 9.5 percent of the protein was found to be digested in the caecum. The production of fatty acids in the rumen was demonstrated. Maximum increases, after the increase due to digestion was eliminated, were 54.9 percent on an alfalfa hay ration and 281.7 percent on a beet pulp ration. The rapid dissipation of fatty acids from the rumen together with the marked synthesis suggest that fatty acids make a highly significant contribution to the nutrition of the ruminant.

The Immunization of Guinea Pigs with Mucoid Phases of Brucella

HUDDLESON, I. F.

Am. Jour. Vet. Res. 8: 374-380. 1947. [Journal Article 888 (n. s.) from the Michigan Agricultural Experiment Station]

When live cell suspensions of certain mucoid growth phases of *Brucella suis* and *Brucella melitensis* were prepared in a suitable concentration and injected into normal guinea pigs, they were capable of engendering a high degree of active immunity against experimental infection with all three species of Brucella.

Cell suspension of *Br. suis*, M phase 2, after irradiation with ultra-violet light to a sufficient degree to render all but a few cells in a 1-mg. dose nonviable, were also capable of producing a high degree of immunity in guinea pigs against experimental infection with *Br. suis* and *Br. melitensis*.

The vaccine-treated guinea pigs that were found free from infection after exposure did not show specific agglutinins in the blood serum in dilutions of 1:25 or above.

The results of the experiments reported herein suggest the possibility of obtaining a high degree of immunity with this type of Brucella vaccine against brucellosis in animals and human beings.

Cannibalism and Feather Picking in Chicks as Influenced by Certain Changes in a Specific Ration

SCHAIBLE, P. J., DAVIDSON, J. A., AND BANDEMER, S. L.

Poultry Science. 26 (6): 651-656. 1947. [Journal Article 890 (n. s.) from the Michigan Agricultural Experiment Station]

The vicious habit of picking feathers, comb, wings, toes, tail, vents, and other parts of the body of the chicken is one of the serious problems of keeping poultry in confinement. Environmental factors as well as nutrition involving various management procedures have been cited as the causes of this habit.

A basal ration containing a high percentage of yellow corn and a low content of protein, phosphorus and fiber produced a high incidence of cannibalism and feather picking in chicks started in a chick starting battery. Various ingredients were added to the basal ration and the difference in cannibalism and feather picking noted. These ingredients included inorganic supplements including different calcium compounds and sodium compounds, several sources of fiber, and various protein supplements.

Certain of the protein supplements seemed to be more effective than others, with casein being the principal ingredient which at various levels reduced the amount of picking and cannibalism. At a 2-percent level, casein reduced cannibalism and improved feathering while 3.6 percent was required to reduce feather picking.

The time of year is not an important factor. The results of these experiments indicate that malnutrition may of itself result in feather picking and cannibalism in White Leghorn chicks.

The Amino Acid Composition of Bovine Semen

SARKAR, RAY B. C., LUECKE, R. W., AND DUNCAN, C. W.

Jour. Biol. Chem. 171 (2): 463-467. 1947. [*Journal Article 893 (n. s.) from the Michigan Agricultural Experiment Station*]

An amino acid analysis of a composite of 149 semen samples obtained from 40 different bulls is reported. These bulls were used routinely for artificial insemination and were of the Holstein, Guernsey, and Jersey breeds. The semen was centrifuged at 5,000 r.p.m. and the sperm separated from the seminal plasma. The sperm and seminal plasma were frozen and dried in this state by sublimation. The concentration of 11 amino acids in the sperm and seminal plasma is reported. With the exception of arginine, leucine, and tryptophan, the amino acid composition of sperm and seminal plasma is quite similar. The arginine content of sperm is very high but is relatively much lower in seminal plasma. The tryptophan concentration in seminal plasma is considerably higher than that found in sperm.

The Establishment and Comparative Wear Resistance of Various Grasses and Grass-Legume Mixtures to Vehicular Traffic

MORRISH, R. H. AND HARRISON, C. M.

Jour. Am. Soc. Agron. 40 (2): 168-179. 1948. [*Journal Article 894 (n. s.) from the Michigan Agricultural Experiment Station*]

In an attempt to measure the comparative wear resistance of grasses and grass-legume mixtures, traffic was applied to a series of plots which had been established in 1943 and 1944. Seedings were made in April, June, August and October of each year in order to determine the optimum time of planting.

Seedings made in April, August and October were superior to the June seedings and produced an average of about 18 percent more ground cover than did the latter. The October seedings performed as dormant seedings and produced cover the following spring. Seeding in excess of 40 pounds an acre did not seem to be justified as measured by the quantity and quality of the sod produced.

All plots were subjected to traffic with a passenger car weighing 3,300 pounds. A truck weighing 4,000 pounds was used on the April and June seedings of the 1943 series. Four hundred trips were made with the car and 210 with the truck on the April and June seedings of the 1943 series.

The major portion of the traffic was applied in October 1946 when the moisture content of the surface soil was approximately 7 percent. Rutting and deformation resulting from the loads applied was negligible.

Kentucky and Canada bluegrass and Chewing's, sheep and tall fescue produced the most wear-resistant turfs. Redtop was intermediate in its resistance to wear, and timothy, bromegrass, and orchard grass were the least resistant. Alfalfa and red clover wore off at the surface of the ground long before the grasses showed any serious effect from traffic. Domestic ryegrass had disappeared from the plots at the time of testing. The inclusion of domestic ryegrass in the mixtures appeared to be detrimental in the establishment of wear-resistant turfs.

The bluegrasses recovered from intensive wear more rapidly than did the fescues. Orchard grass, timothy, and bromegrass were the slowest to re-establish a satisfactory cover.

The Nutritive Value of Canned Food. I. Handling and Storage Procedures for Vegetables Prior to Canning

Marshall, R. E. and Robertson, W. F.

Food Technology. 2 (2): 133-143. 1948. [*Journal Article 897 (n. s.) from the Michigan Agricultural Experiment Station*]

The time interval between harvesting and canning of spinach, asparagus, peas, green beans, sweet corn, lima beans, and carrots was varied from approximately 2 hours to what is generally considered by industry as long-time holding for the several commodities, and methods of holding items other than carrots included: 1) holding in shade at prevailing out-door temperatures, 2) holding in vats continuously supplied with running tap water, 3) washing shelled peas and lima beans before storage to remove viner juice, 4) cold storage at 33° F., and 5) cold storage supplemented by mixing snow ice with the product. The storage treatments for carrots included cold storage and outdoor pit storage. A survey of practices employed by canners indicates a wide range in time intervals between harvesting and processing. Green beans, unlike other commodities tested, do not tend "to heat" at room temperature, and the use of snow ice is not essential in prolonged holdings. Shelled lima beans held in lug boxes in outdoor shade had temperatures 36° and 38° F. higher than air temperatures after 24 hours holding. This commodity should be hydro-cooled and placed in 32° F. storage if the holding period exceeds a very few hours.

Heavy Minerals in Some Podzol Soil Profiles in Michigan

Matelski, R. P. and Turk, L. M.

Soil Sci. 64: 469-487. 1947. [*Journal Article 898 (n. s.) from the Michigan Agricultural Experiment Station*]

A study was made of heavy minerals in some of the northern Michigan podzol profiles in order to aid in explaining certain morphological peculiarities in these soils. It was thought that such a study would aid in revealing geological differences in the soil horizons and in determining the intensity of the weathering processes in various horizons. Two groups of podzol soils were investigated: namely, Emmet, Kalkaska, and Wallace sands, designated as group I; and Grayling, Rubicon, Roselawn, and Eastport sands, designated as group II. Members of group I were characterized by a stronger expression of the Morphological features of typical podzol profiles than were members of group II. Heavy-mineral separations were made on the fine sands and there were significantly greater amounts of heavy minerals in all horizons of the group I soils than in the corresponding horizons of the group II soils. In all the soils, the total amount of heavy minerals was greatest in the C Horizon. In most of the soils, the B Horizon had the lowest content of heavy minerals. The brown B Horizon of these podzols is the result of a vigorous decomposition of a relatively high original content of opaque and ferromagnesian minerals. Organic matter is an effective weathering agent of some heavy minerals in the B Horizons. The least resistant mineral to podzol weathering was found to be dark green hornblende, followed by graygreen hornblende, the opaque minerals, and the garnets. In general, the B Horizons suffered a greater decomposition of the heavy minerals than did the A or C

Horizons. Kalkaska and Emmet sands (soils that support a hardwood cover) contained a greater quantity of calcium and magnesium heavy minerals in all horizons of the profile than did Wallace, Rubicon, Roselawn, and Grayling sands (soils that support a pine cover). The data suggest that the intense brown B Horizon in group I soils is due to a greater amount of iron oxide organic matter and perhaps to a greater original content of the opaque and ferromagnesian minerals (and of the greater decomposition of these minerals) than in the group II soils.

The Detection and Correction of Bacterial Contamination of Milk Bottles in a Bottle Washer

BRYAN, C. S., BORTREE, A. L., AND LUCAS, P. S.

Jour. Milk Food Tech. 10 (6): 319-322. 1947. [*Journal Article 899 (n. s.) from the Michigan Agricultural Experiment Station*]

An instance of bottle washer contamination of milk bottles from a crate washer is described. Physically-clean milk bottles yielded bacteria counts up to 94,000 per quart bottle when this should be no more than 1,000 and usually 200 or less. Chlorination, as the final treatment in the bottle washer, yielded satisfactory bottles, although the contamination continued at the inside rinses. The installation of a vacuum breaker on the water line between the bottle washer and the crate washer corrected the combination problem. The data presented emphasize the importance of proper installation of crate and bottle washers.

A Method of Curing Farm Products by the Use of Drying Agents

DEXTER, S. T. AND CREIGHTON, J. S.

Jour. Am. Soc. Agron. 40 (1): 70-79. 1948. [*Journal Article 904 (n. s.) from the Michigan Agricultural Experiment Station*]

Blocks of wood and other porous materials were impregnated with suitable solutions of calcium chloride, magnesium chloride and other chemicals. These blocks were found effective in removing moisture from the atmosphere. When placed in bins of grain, etc., they continuously removed moisture from the air, thus permitting the grain to dry. With this method of reducing the relative humidity in the storage space, spoilage was prevented. Blocks may be so prepared that they will readily absorb from 50 to 100 percent of their dry weight.

Blood Studies in Dogs Following the Injection of Penicillin

BRINKER, W. O.

North American Veterinarian. 25: 31-33. 1947. [*Journal Article 909 (n. s.) from the Michigan Agricultural Experiment Station*]

Penicillin was administered in various vehicles, dosages, and routes of injection to determine 1) the blood plasma levels of penicillin at different intervals following its administration, and 2) the effect on the peripheral blood. Seventy-one trials were completed, using 12 normal healthy dogs.

Following a single injection of 1,000 units per pound of body weight in a vehicle consisting of 5 percent dextrose in physiological saline, the penicillin blood plasma concentration was found to be approximately the same for all four routes of injection at 30 minutes; however, the penicillin level of 0.03 unit or better was maintained approximately twice as long when the subcutaneous, intramuscular, and intraperitoneal routes were used as compared to the intravenous route.

Penicillin blood plasma levels following the administration of various doses (250, 500 and 1,000 units per pound of body weight) in 5-percent dextrose and physiological saline given intramuscularly and subcutaneously. In this series subcutaneous administration was found to be slightly superior to those following intramuscular administration both in concentration and prolongation of plasma level.

When administered subcutaneously, 5-percent dextrose in physiological saline was found to be equal or slightly superior to the water-in-oil in maintaining penicillin plasma levels. Romansky's Formula was found to excel the above vehicles, as a level of 0.03 unit or better was maintained in all cases at least 6.5 hours following a subcutaneous injection of 1,000 units per pound.

In each trial the first and last blood sample drawn was checked for erythrocyte and leukocyte cell counts, hemoglobin content, and leukocyte differential count. These data indicate that single injections of penicillin in various dosages have no immediate effect on altering the peripheral blood in the normal healthy dog.

The subcutaneous route of injection was found to be the one of choice for ease of administration, least objection on the part of the dogs, and for production and prolongation of the penicillin blood plasma level. No local or systemic reactions were noted following the injection of the various penicillin preparations used in this experiment. On autopsy of the dogs at the termination of the study no macroscopic lesions were found at the sites of injections.

Shrinkage of Spun Rayons in Hand and Machine Laundering

TEAR, J. F.

Rayon Textile Monthly. 28 (9): 83-86. 1947. [*Journal Article 910 (n. s.) from the Michigan Agricultural Experiment Station*]

In recent years, rayon and particularly spun rayon fabrics have replaced cottons for women's wash dresses, for sport wear and children's clothing. One difficulty with rayons—and especially spun rayons—has been dimensional change, the shrinking and stretching of fabrics. The purpose of this study was to determine the amount of dimensional change in a selected group of spun rayons when laundered by hand and by machine. The 37 spun rayons tested were purchased in Michigan in the spring of 1944.

The fabrics that were hand-laundered retained their original texture and appearance better than those that were laundered by machine. The latter looked as though they had been washed and ravelled very badly.

There was no appreciable difference in the amount of shrinkage that occurred in the hand-laundered and the machine-laundered, most of them shrinking 5-percent or more. This amount of shrinkage is so high that any garments made from these fabrics would in all probability be unsatisfactory after laundering.

Delayed Maturity of Bean Plants Sprayed with Solutions of 2,4-Dichlorophenoxyacetic Acid of Non-herbicidal Concentrations

STROMME, E. R. AND HAMNER, C. L.

Science. 107: 170-171. 1948. [*Journal Article 911 (n. s.) from the Michigan Agricultural Experiment Station*]

In a study of the effect of 2,4-D on the growth and development of bean plants, it was found that their maturity was markedly delayed by concentrations of 10 p.p.m. applied just prior to flowering. Maturity was delayed from 2 to 4 weeks. Development of lateral branches from the second node of plants treated with 2,4-D just prior to flowering was a striking feature of the experiment. At harvest time treated plants carried a significantly higher number of leaves per plant and also showed a greater set of fruit.

A Chemical Control of Seedstalk Development in Celery

WITTWER, S. H., COULTER, L. L., AND CAROLUS, R. L.

Science. 106 (2763): 590. 1947. [*Journal Article 913 (n. s.) from the Michigan Agricultural Experiment Station*]

Premature seeding of celery (variety, Cornell 19) was prevented by spraying the young seedlings, prior to cold exposure and field transplanting, with 100 parts per million of alpha-ortho-chlorophenoxy-propionic acid. All plants sprayed with the chemical, whether subsequently exposed to cold or not, remained vegetative throughout the growing season. Similarly handled but unsprayed seedlings produced seedstalks.

A New Technique for Isolating Listerellae from the Bovine Brain

GRAY, M. L., STAFSETH, H. J., THORP, F., SHOLL, L. B., AND RILEY, W. F.

Jour. Bact. 55 (4): 471-476. 1948. [*Journal Article 916 (n. s.) from the Michigan Agricultural Experiment Station*]

Five cases of listerellosis in the bovine were included in this report. *Listerella monocytogenes* was isolated from the brain in only two or three cases on initial culture. After the brain suspensions which were negative on culture had been refrigerated for from 5 weeks to 3 months, all the suspensions yielded the microorganism. The exact mechanism involved has as yet not been determined but reference is made to the possibility of the presence of an inhibitory factor in the bovine brain. Identification of the cultures was confirmed by biochemical reactions and the ability to produce a conjunctivitis when installed into the eye of a rabbit. A true case of encephalitis in the rabbit resulting from ocular installation was also reported.

Storage and Treatment of Milking Machine Inflations under Farm Conditions

JENSEN, J. M. AND BORTREE, A. L.

Jour. Dairy Sci. 31 (5): 331-339. 1948. [*Journal Article 919 (n. s.) from the Michigan Agricultural Experiment Station*]

Farm application of milker inflation storage employing 0.5 percent lye solution, 200 p.p.m. cationic germicide and dry storage was observed through means

of farm inspection, sterile rinse counts of inflations and bacterial counts of milk. Comparison of storage treatment was made using two different procedures on each of two designated milkers on each farm.

The lye and cationic solutions seemed to have equal germicidal value as measured by total rinse counts when solution rack storage was used. The cationic germicide solution caused greater reduction in thermoduric count of rinse water samples than did lye. Lye solution had less germicidal effectiveness than the cationic germicide when immersion storage was used.

Dry storage was least satisfactory in maintaining uniformly low counts of inflations, and high thermoduric counts were associated with cold water washing followed by dry storage. Dry storage after washing and "sanitizing" with 1 gallon of 200 p.p.m. cationic solution was not satisfactory. Some objection to physical properties of the cationic germicide was registered.

Continuous and Rotation Grazing of a Legume Grass Mixture with Dairy Cows

HARRISON, C. M., WILLIAMS, G., AND FISCHER, W. N.

Jour. Am. Soc. Agron. 40 (4): 357-363. 1948. [*Journal Article 921 (n. s.) from the Michigan Agricultural Experiment Station*]

Two 11-acre areas of a mixture containing alfalfa, ladino clover, smooth bromegrass and timothy were grazed over a 2-year period by two lots of dairy cows as nearly alike as possible in production. One area was grazed continuously during the grazing season, the other area divided into three equal areas and grazed in a rotational manner. Volume growth differences caused by rainfall and temperature changes during the season made it difficult to set up any definite time schedule for grazing the rotation fields. The rotation fields gave the best appearance at all times during the test but the cows on the continuously grazed area produced more milk and consumed more grain. The system of rotation grazing proved neither advantageous from a production nor a management standpoint when compared to continuous grazing in this experiment. The problems involved in the management of dairy cows as test animals were much more numerous and difficult than were those when ewes and lambs were used in a similar experiment.

The Correlation of Certain Characters with Yield in Barley Strains

LEASURE, J. K., DOWN, E. E., AND BROWN, H. M.

Jour. Am. Soc. Agron. 40 (4): 370-373. 1948. [*Journal Article 924 (n. s.) from the Michigan Agricultural Experiment Station*]

In 1946, using 75 mildew resistant strains of barley, coefficients of correlation were obtained between plant height, length of head, strength of straw, test weight of grain and yield.

The small size of the coefficients of correlation (some were statistically significant) show that not enough of the variability in yield can be attributed to variation in any one of the factors studied to be of much value in a field selection program.

Evaluation of Some Poultry Remedies

STAFSETH, H. J.

M.S.C. Vet. 8 (11): 56-64, 86. 1948. [*Journal Article 931 (n. s.) from the Michigan Agricultural Experiment Station*]

This work was done at the request of the Food and Drug Administration, Washington, D. C. The purpose was to determine whether certain claims made concerning these "remedies" were true. Millions of dollars are spent by poultrymen throughout the country for worthless remedies, some of which are actually harmful when used under given conditions. The "remedies" concerned were tested under controlled condition *in vivo* and *in vitro* with the following results:

None of the experiments here reported revealed any evidence justifying the use of any of the remedies tested. They proved to be perfectly worthless; in fact, GM seemed to be harmful when given to chickens and chicks affected with pullorum disease.

Medication with the "remedies" employed in these experiments did not materially affect appetite, water consumption or body weight.

So-called intestinal astringents were tested for astringency, coagulation of protein. No results were obtained that would justify their use as "intestinal astringents".

The products, recommended as antiseptics to be used in drinking water, subjected to phenol coefficient and agar cup tests, proved to be entirely worthless.

If potassium dichromate has any value in the medication of poultry, as is thought to be the case in the treatment of pullet disease (Weisner, 1940, and Jungherr and Matterson, 1944), there is certainly no evidence supporting any claims of astringent or antiseptic action in the recommended dosage. This is also true for the other products recommended for use in drinking water and tested in the course of these experiments.

The Geneva Trade Agreements and American Agriculture

WITT, L. W.

Farm Policy Forum I. (2): 52-58. 1948. [*Journal Article 932 (n. s.) from the Michigan Agricultural Experiment Station*]

The tariff and trade agreements made at the Geneva International Conference on Trade and Employment were reviewed. The major tariff reductions on agricultural products made by the United States and by other countries were listed. Agreements on conditions of competition in international trade were discussed briefly.

Major attention was given to the probable effects of the tariff changes on prices of United States agricultural products. Both direct and indirect effects were included.

Relatively minor changes in United States farm prices are likely in the immediate future. In some cases, tariff reductions have led to higher prices for foreign countries selling in the United States. Over a longer period increased competition

will be felt for both agricultural and industrial goods as foreign production is restored. This competition and price effects will be somewhat larger for some farmers because of the tariff reductions.

On the other hand if the tariff agreements are followed by further efforts towards economic integration of the various national economies, the volume of international trade will remain relatively high. Farmers producing export crops, such as wheat, cotton and tobacco, and farmers selling to workers employed in industries with substantial export business, such as the automobile industry, will continue to have large outlets for their produce. Farmers and consumers will benefit from the lower prices for certain imported goods which they buy.

Functional Design of a Milkhouse

BOYD, J. S.

Agr. Eng. Jour. 147-48. 1948. [*Journal Article 933 (n. s.) from the Michigan Agricultural Experiment Station*]

It was necessary to analyze the various milk ordinances influencing the production of milk and determine whether or not one plan could be made to suit different markets. It was found that construction requirements could be standardized and that the most variation was in the equipment required.

There are three functions which must be provided for in a milkhouse: 1) a place where milk can be handled and stored; 2) a place where utensils may be cleaned, and 3) a place where clean utensils can be stored and kept clean between milkings.

The floor area required by ordinances, by the farmers, and by calculations, was determined and compared in graph form. Milk ordinances require more floor space than is actually needed and, from the results of the survey, it was evident that farmers were building according to the milk ordinances which required more room than was needed.

Another factor affecting the use made of the milkhouse, is the distance between the stable and milkhouse. When the milkhouse was adjacent to the stable, the farmer, in most cases, used the milkhouse as a place in which to handle his milk. The value of the milkhouse decreased as the distance from the barn increased. Plans have been prepared which will satisfy both the milk ordinance and our suggestion for good location.

Tetraethylthiuram Monosulfide for the Treatment of Mange and Allied Skin Conditions in a Dog

EADS, F. E. AND HAWKINS, P. A.

No. Am. Vet. 29 (6): 355-358. 1948. [*Journal Article 936 (n. s.) from the Michigan Agricultural Experiment Station*]

A 2- to 5-percent solution of tetraethylthiuram monosulfide applied to the affected area of the body two to four times at 3-day intervals resulted in recovery in most cases of sarcoptic and notoedric mange. A bland soap containing 5 percent of the compound has prophylactic but not therapeutic value when used for bathing dogs. The compound is of some value in treating demodectic mange.

Retardation of Ripening of Fruits with the Methyl Ester of Naphthalene Acetic Acid

MARSHALL, R. E., HAMNER, C. L., AND KREMER, J. C.

Am. Soc. Hort. Sci. Proc. 51: 95-97. 1948. [*Journal Article 940 (n. s.) from the Michigan Agricultural Experiment Station*]

Respiration rates were determined for Jonathan, McIntosh, and Northern Spy apples which had been wrapped with tissue paper, or sprayed with Geon 31X, in which was incorporated the methyl ester of naphthalene acetic acid at concentrations of 1,000 to 10,000 p.p.m. The methyl ester rather consistently retarded respiration rates when used at the lower concentrations with either of the carriers: in one test the average depression amounted to 29 percent.

Bovine Listerellosis in Michigan

GRAY, M. L., THORP, F., SHOLL, L. B., AND RILEY, W. F.

M.S.C. Veterinarian 8 (2): 83-84. 1948. [*Journal Article 939 (n. s.) from the Michigan Agricultural Experiment Station*]

Five cases of listerellosis in the bovine were included in this report. Some of the more prominent symptoms of the disease were discussed. Isolation of *Listerella monocytogenes* was accomplished in three cases only after the brain suspension had been refrigerated.

Effect of Wax Sprays on the Yield of Cherries, Pears and Apples

LANGER, C. A.

Am. Soc. Hort. Sci. Proc. 51: 191-195. 1948. [*Journal Article 941 (n. s.) from the Michigan Agricultural Experiment Station*]

Dowax 222 was applied at the concentration of 1 percent to cherry trees when fruits were starting to turn red and again seven days later. The wax spray reduced the transpiration of the tree and apparently increased in weight by 7½-24 percent. The wax emulsion showed no visual ill effects on the tree or fruit. Quality of fruit was equal to the check trees. The variability in increase in weight can be attributed to the wide variation in red cherry strains and to the varieties of sweet cherries used. The author used the same concentration of spray on pears and apples, the Bartlett pear responded favorably, but the Kiefer pears and apple varieties were negative in their response. Ten to sixteen percent more Bartlett pears attained the 2¼-inch size compared to the check trees.

The Use of Intramedullary Pins in Small Animal Fractures

BRINKER, W. O.

North American Veterinarian. 29: 292-297. 1948. [*Journal Article 943 (n. s.) from the Michigan Agricultural Experiment Station*]

Intramedullary pins were used in the fixation of fractures of the femur, tibia, and mandible of young dogs and cats.

Locations and insertion of the Steinman pins in the various bones was discussed. Transverse fractures were found to be more adaptable for intramedullary pin fixation than other types. The Gordon Extender and open reduction were used to advantage in accomplishing end-to-end alignment which was necessary for insertion of the pin. The main advantages for this method of fixation are tolerance of the animals to intramedullary pins, healing time, and functional results.

Colorfastness of a Selected Group of Spun Rayons

Tear, J. F.

Jour. Home Economics. 40 (5): 259-260. 1948. [*Journal Article 961 (n. s.) from the Michigan Agricultural Experiment Station*]

Widespread use of spun rayon fabrics for women's dresses, sportswear, and children's clothes has stimulated consumer interest in the colorfastness of such fabrics. A selected group of spun rayon fabrics was studied 1) to determine the degree to which they were colorfast to light, to laundering by hand, to crocking, and to perspiration and 2) to learn whether or not any relationship existed between the colorfastness of these fabrics and the prices paid for them. Laboratory tests were conducted to determine colorfastness to light, to perspiration (both acid and alkali), to crocking (wet and dry), and to laundering. After laundering, specimens were checked for bleeding and fading.

On the whole, the fabrics rated highest on their resistance to crocking; three percent crocked when dry and eleven percent when wet. About one-third faded when laundered and more than one-third bled excessively. Thirty-eight percent could not be expected to give satisfactory service when exposed to sunlight. Colorfastness to perspiration was poor; forty-six percent were not colorfast to acid perspiration, and only 43 percent were not colorfast to alkaline.

No consistency was found among ratings in a given price group as to the colorfastness of the fabrics under different conditions, such as light, laundering, crocking, or perspiration. The lowest priced fabrics averaged the highest in colorfastness to light and faded the least when washed, in fact they were colorfast to more tests than any one group. On the other hand, the highest priced fabrics rated the lowest on colorfastness to light and the highest on resistance to crocking. One group averaged high in one respect and low in another. Since a fabric may be colorfast under some conditions, and not under others, any guarantee of colorfastness should state the conditions under which it is colorfast, i.e., to washing, light, perspiration, or to all of these.

Studies on the Morphological and Physiological Characters of a New Species of the Genus Paecilomyces

Hsie, Jen-Yah, Jubb, Annanell C., and Stafseth, H. J.

Soc. Am. Bact. Proc. 1 (1): 43-44. 1948. [*Journal Article 964 (n. s.) from the Michigan Agricultural Experiment Station*]

This work was done for the purpose of identifying an organism which had been found to be present in the blood, spleen and kidneys of rats in the stock colony of the Department of Foods and Nutrition. The possibility that it was

responsible for low fertility in rats in the stock colony had been expressed. No gross pathological manifestations had been observed. In tissues the organism resembled certain protozoa. The organism was maintained on cornmeal agar medium, and the following media were used for cultural and morphological studies: Sabouraud broth, modified Sabouraud agar, Czapek medium, nutrient broth, beef extract agar and carrot slants. Growth was studied in slide culture using modified Sabouraud medium and Czapek medium. Physiological characteristics were studied in the usual manner. It produced acid but no gas in dextrose and maltose and hydrolyzed starch. No fermentation took place in sucrose, lactose, mannitol, salicin, xylose, inositol arabinose, dulcitol and rhamnose. Gelatin was not liquefied. The pigment of its gonidia is soluble in ether, insoluble in chloroform, benzene, alcohol and distilled water. Its optimum temperature is approximately 37°C. for 10 minutes in dry heat. It survived desiccation for 40 days. It was identified as a new species of the genus *Paecilomyces* for which the name *Paecilomyces michiganensis* is proposed.

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